

THE PANAMA GATEWAY



JOSEPH BUCKLIN BISHOP

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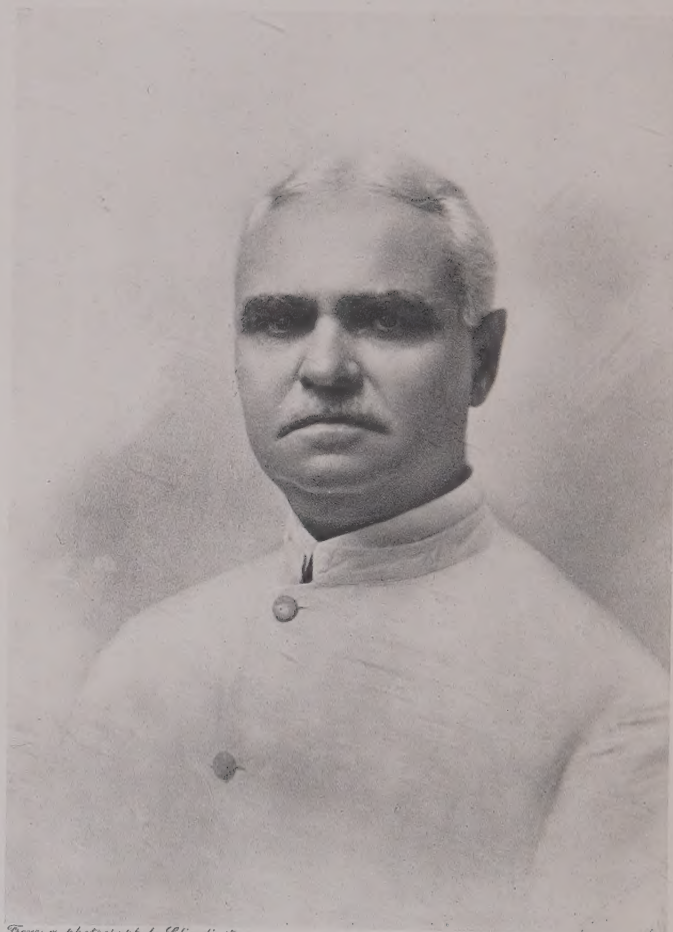
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THE PANAMA GATEWAY



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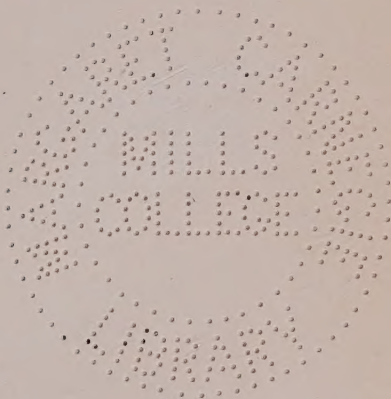
THE PANAMA GATEWAY

BY

JOSEPH BUCKLIN BISHOP

SECRETARY OF THE ISTHMIAN CANAL COMMISSION

ILLUSTRATED



NEW YORK

CHARLES SCRIBNER'S SONS

1913

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To
MY WIFE AND DAUGHTER
CHEERING AND HELPFUL
COMPANIONS IN EXILE

CONTENTS

PART I

HISTORICAL

1502-1879

CHAPTER	PAGE
I. COLUMBUS AND THE ISTHMUS—HIS SEARCH FOR THE HIDDEN STRAIT—BALBOA'S DISCOVERY OF THE PACIFIC—HIS JUDICIAL MURDER BY AVILA AT ACLA	3
II. FOUNDING OF OLD PANAMA—THE CITY'S GROWTH AND IMPORTANCE—EXAGGERATED ACCOUNTS OF ITS SIZE AND WEALTH—THE NEW CITY	13
III. FIRST TRANSIT ROUTES ACROSS THE ISTHMUS—EARLY PROJECTS FOR A WATERWAY—THREE CENTURIES OF SPANISH RULE AND OBSTRUCTION	27
IV. AWAKENING OF AMERICAN INTEREST	32
V. A CANAL FOR ALL NATIONS	36
VI. THE FIRST PANAMA RAILROAD	44
VII. A FIFTY-YEAR OBSTACLE	54

PART II

THE FRENCH EFFORT AND FAILURE

1879-1902

I. LEADERSHIP AND METHODS OF FERDINAND DE LESSEPS—HIS INTERNATIONAL CONGRESS OF 1879—PURCHASE OF THE FIRST CANAL CON- CESSION	63
--	----

CHAPTER		PAGE
II.	LESSEPS'S FIRST VISIT TO THE ISTHMUS—FIRST BLOWS OF PICK AND DYNAMITE	69
III.	ESTIMATED COST OF THE PROPOSED CANAL— REDUCED BY LESSEPS—NO SUBSCRIPTIONS IN UNITED STATES—ABUNDANCE IN FRANCE .	75
IV.	WORK ON THE ISTHMUS—SECOND VISIT OF LES- SEPS	78
V.	LIFE AT PANAMA IN FRENCH DAYS—ITS PECU- LIARITIES, HARDSHIPS, AND PERILS—EXTRAV- AGANCE AND GRAFT	84
VI.	PESTILENCE AND DEATH—RAVAGES OF YELLOW FEVER—TESTIMONY OF EYE-WITNESSES— HEROISM OF THE MEN IN THE FIELD . . .	91
VII.	RETURN OF LESSEPS TO FRANCE—COLLAPSE OF HIS COMPANY—SHOCKING REVELATIONS OF ITS FINANCIAL PROCEEDINGS—WORK DONE AT PANAMA—SENTENCE AND DEATH OF LESSEPS	99
VIII.	NEW FRENCH CANAL COMPANY	106

PART III

AMERICAN PURCHASE AND CONTROL

1902-1904

I.	CONTEST BETWEEN NICARAGUA AND PANAMA ROUTES—DECISION IN FAVOR OF THE LATTER	113
II.	COLOMBIA'S REJECTION OF THE HAY-HERRAN TREATY	118
III.	THE PANAMA REVOLUTION	123
IV.	THE REPUBLIC OF PANAMA	132

CONTENTS

ix

PART IV

PERIOD OF CONSTRUCTION

1904-1915

CHAPTER		PAGE
I.	BEGINNINGS OF AMERICAN RULE AND WORK .	143
II.	THE TAFT "MODUS VIVENDI" WITH THE REPUBLIC OF PANAMA	149
III.	INEFFICIENCY OF A SEVEN-HEADED EXECUTIVE BODY—FAILURES AND REMOVAL OF THE FIRST COMMISSION	155
IV.	REORGANIZATION OF THE COMMISSION ON EFFECTIVE LINES—JOHN F. STEVENS AS CHIEF ENGINEER—INTERNATIONAL CONSULTING BOARD—LOCK CANAL DECREED	160
V.	VISIT OF PRESIDENT ROOSEVELT—CANAL MEDALS—SPECIAL MESSAGE TO CONGRESS—REBUKE TO CALUMNIATORS	169
VI.	THE THIRD COMMISSION—U. S. A. ENGINEERS IN CHARGE—QUALIFICATIONS OF COLONEL GOETHALS—THE CANAL RECORD	175
VII.	CULEBRA CUT—ONE-FOURTH OF ITS ENTIRE EXCAVATION DUE TO SLIDES AND BREAKS . .	184
VIII.	THE WONDERFUL CULEBRA CUT	193
IX.	CHANGES IN CANAL PLANS—LARGER LOCKS AND WIDER CHANNEL—ESTIMATES OF TOTAL COST	198
X.	GATUN DAM AND LOCKS—FIRST SUGGESTION OF THE SITE—ITS NATURAL ADVANTAGES—HUMOROUS AND OTHER ASSAULTS	202
XI.	LOCKS AND DAMS ON THE PACIFIC SIDE—THE TASK MUCH SIMPLER THAN THAT AT GATUN .	217
XII.	SANITATION OF THE ISTHMUS—SCIENTIFIC DISCOVERIES WHICH MADE IT POSSIBLE—MARTYRDOM OF LAZEAR	222

CHAPTER		PAGE
XIII.	ACTIVE WORK UNDER COLONEL GORGAS AND THE DEPARTMENT OF MUNICIPAL ENGINEERING—FINAL OUTBREAK AND ROUT OF YELLOW FEVER	238
XIV.	COMPLETENESS OF THE VICTORY OVER YELLOW FEVER—REWARDS GIVEN BY CONGRESS TO THE MEN WHO MADE IT POSSIBLE . . .	245
XV.	WARFARE UPON MALARIA—COST OF MAKING THE ISTHMUS HEALTHFUL—IS IT A HEALTH RESORT?	249
XVI.	THE EVOLUTION OF A "BENEVOLENT DESPOTISM"—INDUCEMENTS TO ENTER THE CANAL SERVICE	258
XVII.	ESTABLISHING A FOOD-SUPPLY AND ASSEMBLING A LABOR FORCE	265
XVIII.	PROVISIONS FOR THE COMFORT AND CONTENTMENT OF THE FORCE—CLUB-HOUSES AND OTHER AGENCIES	273
XIX.	AUTOCRATIC POWER CONFERRED ON THE CHAIRMAN AND CHIEF ENGINEER—RULE OF THE "BENEVOLENT DESPOT"	281
XX.	A SQUARE DEAL FOR ALL—AN OPEN DOOR FOR ALL COMPLAINTS—GOOD EFFECTS OF THE POLICY—A NOVEL COURT OF JUSTICE . .	290
XXI.	CANAL LABORERS—DIFFERENT NATIONALITIES EMPLOYED—CHARACTERISTICS AND EFFICIENCY—EFFECTS OF CLIMATE AND OF CIVILIZATION	299
XXII.	LIFE IN THE CANAL COLONY—ITS ATTRACTIONS, DISTRACTIONS, PECULIARITIES, AND SPECIAL CHARM	308
XXIII.	THE NEW PANAMA RAILROAD	318

CONTENTS

xi

CHAPTER	PAGE
XXIV. VALUE OF THE FRENCH PROPERTY—WHAT THE UNITED STATES RECEIVED IN RETURN FOR THE PAYMENT OF \$40,000,000 TO THE FRENCH COMPANY	324
XXV. AMERICAN AND FRENCH MACHINERY—RELATIVE CAPACITIES OF THE TWO EXCAVATING PLANTS	330
XXVI. VETERANS IN THE CANAL SERVICE	342

PART V

THE COMPLETED CANAL

I. NOT A CANAL THROUGH THE ISTHMUS, BUT A BRIDGE OF WATER ABOVE IT	351
II. GATUN DAM, SPILLWAY, AND HYDRO-ELECTRIC STATION	355
III. LOCKS AND GATES	362
IV. PASSAGE OF THE LOCKS	369
V. ELECTRIC CONTROL OF LOCK MACHINERY	376
VI. LIGHTING SYSTEM	380
VII. THE APPROACH CHANNELS	384
VIII. PERMANENT CANAL BUILDINGS	390
IX. TERMINAL FACILITIES, DRY-DOCKS, AND REPAIR-SHOPS	395
X. FOOD, COAL, OIL, AND OTHER SUPPLIES	400
XI. FORTIFICATIONS	408
XII. THE CANAL ZONE A MILITARY RESERVATION	415

APPENDIXES

	PAGE
A. CANAL COMMISSIONS	425
B. CANAL APPROPRIATIONS AND EXPENDITURES . . .	428
C. AN ACT TO PROVIDE, ETC.	430
D. EQUIPMENT AT PERIOD OF GREATEST ACTIVITY . .	447
INDEX	451

ILLUSTRATIONS

Colonel George Washington Goethals	<i>Frontispiece</i>
Vasco Nuñez de Balboa	FACING PAGE 6
Sir Henry Morgan	6
The tower of cathedral in Old Panama	14
Bridge on ancient road to Old Panama	16
Ruins of sea-wall at Old Panama	16
Picturesque sea-wall, Panama	18
Cathedral Plaza, Panama City	20
The flat arch in ruins of San Domingo church	20
Plan and perspective of the City of Panama, 1688	22
Plaza, 1748	24
The American settlement and quarry plant at Porto Bello	28
Street scene in Old Porto Bello	30
Village of Cruces, Canal Zone	30
John C. Trautwine	48
Colonel George M. Totten	48
Scene on the old Panama Railroad, now under Gatun Lake	50
Count Ferdinand de Lesseps	70
Columbus statue on water-front, Cristobal, near Lesseps residences	80

	FACING PAGE
Count Ferdinand de Lesseps, his second wife, and nine children	82
Group of Lesseps and his friends	82
Grand Hotel, Panama	86
Front Street, Colon, during the flourishing French times	86
"La Folie Dingler"	94
French machinery in the jungle	94
Christening the flag of the Republic of Panama, Panama City, November 6, 1903	134
Founders of the Panama Republic	138
First Commission for Canal Construction	144
John F. Wallace	162
John F. Stevens	162
Second Commission for Canal Construction	164
The International Board of Consulting Engineers	166
President Roosevelt addressing President Amador on the steps of the Cathedral, Panama, November 15, 1906	170
Builders of the Canal	176
The Third Commission for Canal Construction	180
Culebra Cut. Cucaracha slide. Steam-shovel working on the bottom of the Canal, January 4, 1913	188
Culebra Cut, looking north from La Pita, showing close view of rock break in east bank, October 9, 1912 . . .	196
Old village of Gatun from dam site, November, 1906 . .	200
Canal Channel, looking south from San Pablo to Caimito	200
Gatun Upper Locks. The foot-bridge across the Upper Guard gates, January 14, 1913	204

ILLUSTRATIONS

XV

FACING

PAGE

Special Commission of Civil Engineers, January, 1909	208
Gatun Locks, looking toward the Atlantic, June 1, 1913	214
Spillway Dam. Regulation gates in position between the piers, June 1, 1913	218
Emergency dam swung across entrance of Gatun Lock, June 1, 1913	218
Pedro Miguel Locks, January 25, 1912	220
Gatun Upper Locks. South entrance to east chamber	220
Heroes of the yellow-fever tests	228
Camp Lazear	232
Types of Canal quarters	278
Arrival of 1,500 laborers from Barbados at Cristobal on S. S. <i>Ancon</i> , September 2, 1909	300
White Canal laborers	304
Sir Claude Coventry Mallet	314
Lady Mallet	314
The embankment across the valley of the Gatun River in first stages of construction, June, 1910	320
New Panama Railroad. Gold Hill Line. Looking north up the Pedro Miguel Valley, June, 1912	322
Culebra Cut, looking north, as left by the French. Amer- icans using French equipment, December, 1904	332
French transporter	332
Track-shifting machine which does the work of 600 men	336
Steam-shovel loading rock, Culebra Cut	336
A spreader at work, Corozal Dump, August 31, 1907	338

	FACING PAGE
Dirt train and Lidgerwood unloader, Juan Grande, January, 1907	338
Veterans in the Canal service	344
Breakwater at the Pacific entrance, extending to Naos Island, with Balboa Dump in the foreground . .	388
First of the permanent docks at Cristobal	396
Letting the Pacific Ocean into the canal, May 18, 1913 .	396
Map showing Isthmus with completed Canal. <i>At end of volume</i>	

PART I
HISTORICAL
1502-1879

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CHAPTER I

COLUMBUS AND THE ISTHMUS—HIS SEARCH FOR THE
HIDDEN STRAIT—BALBOA'S DISCOVERY OF THE
PACIFIC—HIS JUDICIAL MURDER BY AVILA AT
ACLA

THE Panama Canal is the realization of an idea four centuries old. It dates almost from the discovery of America by Columbus, for scarcely had he found the new continent when he began the search for a passage through the centre of it. The native Indians had told him of a "narrow place between two seas." He interpreted this to mean a waterway, though they had in mind the Isthmus of Panama. In his imagination this became the "hidden strait" which would prove to be that westward passage to Asia which he sought, and through which he hoped to sail and circumnavigate the globe. In his fourth and last voyage, which began in May, 1502, and lasted nearly two years, he sailed along the entire northern coast of the Isthmus of Panama, from Honduras to the Gulf of Darien, seeking eagerly and confidently in every recess of the

shore line for the "hidden strait." He discovered and named the Bay of Puerto Bello, entered what is now Limon Bay and the harbor of Colon, and explored the mouth of the Chagres River. Thus he was seeking for the waterway which he supposed nature had supplied, in the very region through which the canal of to-day, constructed four hundred years later by the hand of man, joins the two oceans.

Failure to find the "hidden strait" did not shake the faith of Columbus in its existence, and he died in 1506 as firmly convinced of its reality as he was ignorant of the fact that he had discovered a new world. The contemporary explorers, whom his discoveries had inspired in England, Germany, and France, and who sailed across the Atlantic after him to the new lands, all shared his faith. They sought the "hidden strait" in eager rivalry and in complete ignorance that a new world had been found. Even when Vasco Nuñez de Balboa, his curiosity aroused by the talk of the native Indians about a "mighty sea beyond the mountains," climbed the Cordilleras and discovered the Pacific, the truth was not suspected.

Balboa was one of the most intrepid and reckless of the many soldiers of fortune who had hastened to the New World soon after Columbus discovered it. Arriving in 1500, he led a riotous and variegated existence in the new colonies, until finally he became so deeply involved in debt while living on the island of Hispaniola, now Hayti, that he escaped from his creditors hidden in a cask supposed to contain provisions. He had the cask taken on board a vessel which was about

to sail on an expedition to find a suitable site for a new colony. When the ship was well under way, Balboa emerged from his cask, made friends with the commander and his associates, and finally, when the expedition was in danger of failure through troubles with hostile Indians, took virtual command and guided it into the Gulf of Darien, where a prosperous Indian village was attacked and overcome and a colony founded which subsequently became the city of Santa Maria de la Antigua del Darien. Balboa made himself so popular in the new colony that in due course he became its alcalde, or ruler of the province. It was while holding this office that he heard the Indians of the country speak of the "mighty sea beyond the mountains" which could be seen from their loftiest peak. The Indians told him also that "all the streams that flow down the southern side of those mountains abound in gold."

His curiosity aroused by these tales, Balboa determined to ascend the mountains and see for himself. He organized an expedition of one hundred and ninety Spaniards, a number of native Indians, and several bloodhounds, which were said to be of great service in fighting Indians, who fled in terror at the mere sight of them.

Balboa started with this expedition from Santa Maria de la Antigua on September 1, 1513, embarking in a brigantine and nine large canoes. He proceeded northward along the coast for about sixty miles, to a point near Puerto Carreto or Careta. Here he landed, and on September 6 turned westward to cross the

summits of the Cordilleras. Progress was very slow because of the well-nigh impassable country, and while some of the native Indians were friendly, others were hostile, and several encounters with the latter took place, in which many of the Spaniards were wounded. So arduous had been the journey that when the band reached the foot of the mountain from the summit of which the Indians told him the great ocean could be seen, only sixty-seven of the one hundred and ninety Spaniards were able to proceed. With these Balboa climbed the mountain, and at about 10 o'clock on the morning of September 25, 1513, old style, October 5, new style, he first saw the waters of the Pacific, making up into a deep gulf. The precise peak on which he stood is unknown. Several are named, but only conjecturally.

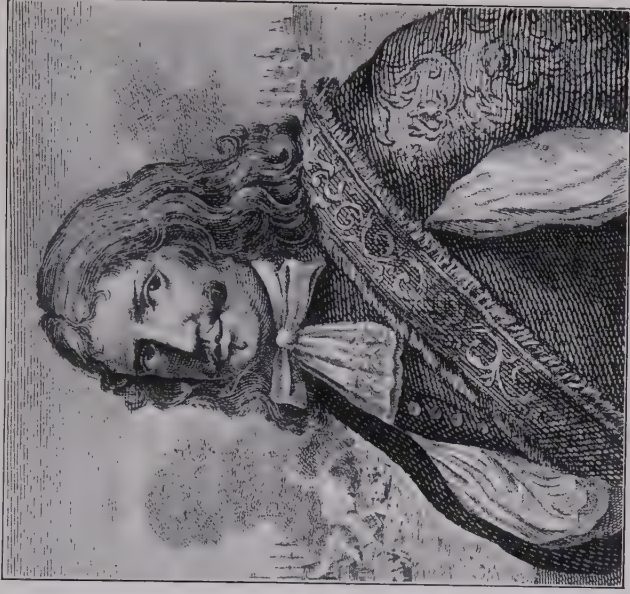
Four days later he reached the shores of the ocean, which he named the South Sea and took possession of in the name of the King of Spain. Not only was Balboa the discoverer of the Pacific but the first white man to cross the Isthmus of Panama. To the gulf he gave the name of San Miguel, because the day on which he reached it, the 29th of September, is celebrated by the Catholic Church as that saint's feast-day. This name it has since borne.

There is an erroneous impression, quite prevalent in the United States, that the mountain from which Balboa first saw the Pacific lies within the Canal Zone. Indeed, one veracious historian has declared Gold Hill, the highest point of the Culebra Cut, to have been the peak, and has set forth with much elo-



By courtesy of the Hispanic Society of America.

Vasco Núñez de Balboa.



Sir Henry Morgan.

quence the emotions which he himself experienced as he stood on that spot, in the very footprints of Balboa. There is near the line of the canal, a few miles west of the northern entrance to Culebra Cut, a hill about one thousand feet in height, which is called Balboa Hill, because from a lookout in the trees on its summit both oceans can be seen on a clear day. But the mountain on which Balboa stood was fully one hundred and twenty-five miles east of the Canal Zone line, on the extreme eastern coast of the isthmus, and north of the Gulf of Darien. The location above the Gulf of San Miguel establishes that fact beyond question.

As reward for his discovery of the Pacific the King of Spain made Balboa governor of the province of Castilla del Oro, which extended from Cape Gracias á Dios, on the extreme eastern coast of Honduras, to the Gulf of Ureba or Darien, giving him the title of "Adelantado de la Mer del Sur." But hardly had Balboa assumed office when Ferdinand sent Pedro Arias de Avila from Spain with an expedition of two thousand men with orders to found a colony on the coast of the new ocean and supersede Balboa as governor. Avila, who is known in history under this name, and also under several variations of it, of which the most common is Pedrarias, was at the time a colonel of infantry who had served with distinction in the Moorish wars of Spain and Africa. His subsequent career showed him to be one of the most treacherous, inhuman, and rapacious of the many wild beasts in human form that Spain was sending forth into the

world at that time—soldiers, pirates, buccaneers, whose profession was pillage and whose pastime was murder.

Avila arrived in the Gulf of Darien, off the colony of Santa Maria de la Antigua, in June, 1514. He was well received by Balboa, who had no suspicion of what his fate was to be at the hands of the new ruler. Avila, who was jealous of Balboa's great fame as the discoverer of the South Sea, and of his popularity in the colony because of his bravery and his ability and fairness as a ruler, began at once to lay plans to get rid of him. He had Balboa arrested and tried on various trumped-up charges, and was greatly incensed when the trial resulted in acquittal. He subsequently sanctioned Balboa's request for permission to fit out an expedition to explore the South Sea, and Balboa proceeded with his usual energy and zeal to make preparations. As there was no suitable timber on the south or Pacific side, he had such as he needed for the construction of his ships cut on the Atlantic side, in the vicinity of Puerto Carreto.

Balboa had the timber for his ships, together with anchors, rigging, and all other material, carried across the isthmus on the backs of Indians. The task involved tremendous hardships, occupied many months, and cost the lives, it is said, of hundreds of Indians, for the trail was over rugged mountains, across numerous mountain torrents, and through dense forests. During the journeyings Balboa discovered a large river flowing from the mountains into the Gulf of San Miguel, which he named Rio de las Balsas, or "River

of the Rafts," which is supposed to be the river now called Sabana. In two brigantines which he succeeded in constructing Balboa sailed to the Pearl Islands, to which he gave that name, which lie in the Gulf of Panama, about fifty miles off the Gulf of San Miguel, and then turned back. Avila sent messengers to him commanding him to return to Acla to vindicate himself from certain charges that had been brought against him. He was at once seized and thrown into prison, and after a trial which was such only in name, was convicted, sentenced to death, and, with four of his companions, beheaded in January, 1519. Two of these companions, Andrés de Valderrabano and Herman Muños, had stood with Balboa on the mountain top when he first saw the Pacific.

While on the scaffold awaiting execution, proclamation was made that Balboa was condemned to death as a traitor and usurper of the territories of the Crown. With great indignation he exclaimed: "It is a lie! It is a lie! No such crime ever entered my mind. I have served the King with loyalty, with no thought except to enlarge his dominions."*

The town of Acla owes the preservation of its name in history solely to this execution. It was founded in 1515 by Gabriel Rojo under the orders of Avila, and retained the name given to the locality by the Indians, it signifying "bones," because it had been the scene of many bloody battles between two rival tribes that had as chiefs two brothers. Avila chose the site as the most favorable one for a settlement which should

* Juan B. Sosa.

serve as a basis of communication with the town which he intended to build on the Gulf of San Miguel. There has been much dispute among historians as to its exact location. Juan B. Sosa, the Panama historian whose work on the early history of the isthmus, based on careful and exhaustive study of the original archives in Spain, must be accepted as final authority, places it on the extreme point of the peninsula which forms the outer barrier of Caledonia Bay, called Puerto Escoces. It was never more than a small village of thatched huts, protected by a wooden stockade against the native Indians, who were the only enemies against whom the Spanish colonists had to guard themselves. It was abandoned in 1532, and no trace of it has been discoverable for centuries. The unfortunate Scotch settlement or colony, led by William Paterson, selected the same site for its ambitious town of New St. Andrew, in 1698, abandoning it a year later after intense sufferings. The year of Balboa's execution has been a matter of uncertainty, some authorities giving 1517 and others 1518. I have accepted the authority of Sosa for 1519.

It had been Balboa's ambition to sail through the South Sea to the southward in search of the "Land of Gold" (Peru), which the Indians told him existed there. Ten years later, one of his companions in the discovery of the Pacific and in his voyage to the Pearl Islands, Francisco Pizarro, carrying out the designs of Balboa as he had learned them from him, discovered Peru, and six years afterward made conquest of it. What the future of Peru might have been had Balboa

instead of Pizarro discovered it is an interesting subject for speculation.

It was not till seven years after Balboa's discovery of the new ocean that its name was changed from the South Sea to the Pacific. On November 28, 1520, Ferdinand Magellan, a Portuguese navigator sent out by Charles V of Spain to find the "hidden strait," having sailed south from the mouth of the La Plata, on the South American coast, found the strait which bears his name and passed through it into a great body of water, which, because of its calm character and the fine weather which he experienced while on it, he named the Pacific Ocean.

These discoveries of Balboa and Magellan, as well as that of two Dutch navigators, Schouten and Le Maire, who in 1616 sailed around Cape Horn into the Pacific, did not dispel faith in the existence of the "hidden strait" farther north, although repeated failure to find such a passage had somewhat shaken it. Very slowly, but surely, as new discoveries in North and South America were made, there was developed a realization that a new world had been found which was in no sense a part of the old, and that it lay directly across that route to the East which had been sought with such indomitable courage and persistence in the face of supreme hardship by Columbus and the hardy navigators who followed in his wake in the last years of the fifteenth and the first half of the sixteenth centuries.

With loss of faith in the existence of a hidden strait there was born a demand for the opening of a strait

through the obstructing land. This owed its origin to, and was steadily strengthened by, the rapidly growing importance of the Spanish colonies on the Atlantic side of the isthmus that had sprung up after the first voyages of Columbus, and by the discovery of the Inca Empire and the rich mines of Peru. Early in the sixteenth century Ferdinand of Spain directed that a line of posts be established between the new settlements on the Pacific side of the isthmus and the Atlantic.

CHAPTER II

FOUNDING OF OLD PANAMA — THE CITY'S GROWTH AND IMPORTANCE — EXAGGERATED ACCOUNTS OF ITS SIZE AND WEALTH — THE NEW CITY

THE most important of the new settlements on the Pacific side from which transit routes were opened across the isthmus was the first city of Panama. This was founded in 1519 by Avila soon after his judicial murder of Balboa. So much misinformation has crept into historical writing both about the method of the city's founding and its size and wealth in the days of its greatest prosperity and power that it seems desirable to give here a somewhat fuller account of it than accords with the studiously condensed scope of the present historical narrative.

Avila's treatment of Balboa, combined with his many other brutalities and murders as governor of the province of Castilla del Oro, not only had made him thoroughly detested, but, what was far more serious for him, had deprived him of the sympathy and support of the Jerome monks of Santo Domingo, who, by authority of the Crown, exercised jurisdiction over all lands that had been discovered in the West Indies. He was virtually powerless, though nominally governor. To rid himself of ecclesiastical opposition and to regain

his lost popularity by means of new ventures, he decided to execute the royal order to found a settlement on the Gulf of San Miguel which should serve as a centre for all expeditions and enterprises in that region. Accordingly, in July, 1519, he assembled a band of four hundred followers and crossed the mountains to the headwaters of the Gulf of San Miguel, over the route taken by Balboa. Embarking in Balboa's ships with the intention of seeking a site for a new settlement on the shores of the gulf, his curiosity led him much farther, for he sailed out of the gulf into what is now known as the Bay of Panama, passing first the Pearl Islands, then the islands of Taboga and Taboguilla, and then those of Flamenco, Naos, and Perico, which are now the bases of the American fortifications at the Pacific entrance to the canal, until he came to a deep and shallow bay, about four miles east of the site of the present city of Panama. Here he cast anchor, attracted by the wide acres of level and rolling country lying between the coast and the blue summits of the Cordilleras rising far away in the east and north. At the head of this bay he found a squalid little Indian village, called by its inhabitants Panama, signifying "abounding in fish," because of the plentifulness of fish in its waters.

Like many other matters in Panama history, there are conflicting legends about the real meaning of this name. One is that it was the name of a cacique who lived in the vicinity at the time of the arrival of the conquistadores. Another is that it signifies the "land or place of the mariposas," and still another is that it



The tower of cathedral in Old Panama.

Destroyed by Morgan in 1671.

was the name of a tree abounding on the site of the city at the time of its founding. In support of the last-named legend a picture of a tree which is to be seen in all parts of the isthmus and in other tropical countries is produced in some ambitious histories. But the accurate meaning is the one I have given, as Sosa shows conclusively. "Panama" is derived from the primitive language of the Cueva Indians, which was the language most extensively used by the aborigines of the isthmus, and it meant "abundance of fish," or "place abounding in fish." Sosa cites in support of this derivation a letter written by Avila himself in 1516 to King Ferdinand and his daughter, Princess Juana, in which he says: "Your Highness should know that Panama is a fishing place on the coast of the South Sea, for the Indians call fishermen 'Panama.'" This citation shows that Avila knew of the existence of the place three years before he founded his city there.

Avila decided to found there his new settlement, induced probably by the attractive country lying near the shore, for the bay was very shallow even at high tide, and at low tide was completely devoid of water. On August 15, 1519, under the orders of Avila and in accordance with the royal decree, the new city was formally established by Gaspar de Espinosa, chief alcalde of the Darien, and was called Panama. As rapidly as possible the civil and ecclesiastic governments were transferred to Panama from Santa Maria de la Antigua, and the people with their flocks, herds, and other possessions followed. On September 15, 1521, Panama was made a city by royal decree of Charles V, and was

granted a coat of arms. The abandoned city of Santa Maria de la Antigua was assaulted by Indians in September, 1524, its few remaining habitants were butchered, and the city itself was reduced to ashes.

Pizarro fitted out his first expedition to Peru at Panama in 1524, which was a failure, and his second in 1526, which was more successful, and his third, which resulted in the conquest of Peru, in 1531. Avila continued as governor till 1526, when, in consequence of many and grievous complaints, he was transferred to Nicaragua, where he died in 1531.

The city of Panama grew rapidly from the moment of its establishment. Its position as the chief port of the Pacific and terminus of the first transit route across the isthmus was the main cause of this. The defects in its site were very soon apparent. Its harbor was not only unsuitable as a port of entry and departure for even medium-sized vessels, but was unsafe as an anchorage, and vessels had to anchor as far away as Perico, and even Taboga. Furthermore, the locality was unhealthy and the town was a constant sufferer from sickness. In 1531 a plebiscite was taken on the question of removal to a more sanitary site with a better harbor, but the decision was adverse because of the large sums that had been expended for buildings and other purposes, and because there was within the province no site with a better harbor.

In spite of the disadvantages and defects of its location, the city increased steadily in size and wealth. It was the centre, emporium, and port for all commerce and travel between Spain and Spanish posses-



Bridge on ancient road to Old Panama.



Ruins of sea-wall at Old Panama.

sions on the Pacific. Through it passed all the vast output of gold and silver from the rich mines of Peru; the output of mines in the isthmus province of Veraguas, which at one time employed a thousand laborers; the product of the pearl fisheries in the Bay of Panama, in which hundreds of men and thirty brigantines were engaged; and all the merchandise that went to and fro between Spain and her West Indian colonies.

In 1563 the city suffered severely from fire, but was quickly rebuilt, and in 1575, fifty-six years after its foundation, it comprised about 400 buildings, nearly all of wood, about 500 Spanish residents, mainly coming originally from Seville, and more than 3,000 negroes, or a total population of about 4,000.

So great had been the commercial activity and wealth of the city by 1580 that in that year a mint was established for the coinage and stamping of gold from the mines, which, free from alloy and in crude forms, constituted the chief medium of exchange in commercial transactions. In December of the following year, by royal decree, the title *Muy noble y muy leal* (Very noble and very loyal) was conferred upon the city, and its *rigidores*, or magistrates, were given the right to call themselves "The Twenty-four," thus placing the city in the rank of Seville and Cordova, the foremost cities of Spain. Panama was thus recognized as the first city of the New World.

In 1610 the number of buildings had increased to 500, among which only eight were of rough stone and mortar. The city covered almost 150 acres, had three public

squares and eleven streets, all paved with stones. In 1640 the population was estimated at about 8,000, of whom about 7,000 were negroes, and the number of buildings was about 750.

A second and disastrous fire destroyed a large section of the city on February 21, 1644. Among the buildings burned were those of the ecclesiastical authorities and the cathedral church. The latter, though a frame building, is said to have been a structure of considerable architectural merit. The conflagration checked temporarily the growth of the city and sent many of its inhabitants to seek homes elsewhere. Writing of it soon afterward to King Philip of Spain, the governor of the city said:

Panama is at present but a small town which decreases more and more every day. The fields and roads are full of people without houses or shelter.

The city made valiant efforts to recover from this disaster during the remaining twenty-seven years of its existence and had barely succeeded when Morgan and his buccaneers assaulted and destroyed it in 1671. The cathedral was rebuilt in stone, with three spacious naves, and with a stately tower, the impressive ruins of which still stand as the chief landmark of the old city on the shore of Panama Bay. Its stalls, or seats in the choir, we are told by Sosa, were made of mahogany, its organ loft was finished in cedar wood, and its inner chapel was richly decorated. Other buildings of similar construction erected before the fire of 1644 and spared apparently from its ravages were a hos-



Picturesque sea-wall, Panama.

pital for men and another for women, six convents and two chapels. There were also a *Cabildo*, or city hall, a building for the Court of Justice and Prison, a house for the President and Supreme Court Judges, an accountant's office, and a "splendid building" for the slave traffic, owned by a private company. How many of these were stone is not known. Sosa says that, notwithstanding its commercial importance and political power as the first city of the New World, and "in spite of the magnificence which history wishes by exaggeration to assign to it," Panama did not attain at the height of its prosperity "an exterior structure superior to that of our present chief provincial towns," aside from its convents, public buildings, hospitals, and bridges. The same authority places the population of the city at the time of its greatest size at about ten thousand, the greater part of whom were negroes, and the number of buildings of all kinds at approximately one thousand.

The fountain and source of all the exaggerated stories of the wealth and magnificence of Old Panama, with which historical writing about the isthmus has been disfigured for two hundred and thirty years, is the famous narrative of John Esquemeling, published in 1678. He was one of Morgan's band and took part in the sacking of the city in 1671. There is no more entrancing reading in piratical history than his account of Morgan's exploits, and especially the march across the isthmus and the assault and destruction of Panama.*

* "The Buccaneers of America," by John Esquemeling. In Dutch, Holland, 1678; in English, London, 1684.

In it he gives this description of the city which he helped to sack:

All the houses of this city were built with cedar, being of very curious and magnificent structure and richly adorned within, especially with hangings and paintings, whereof part was already transported out of the Pirates' way, and another great part was consumed by the voracity of the fire.

There belonged to this city (which is also the head of a bishopric) eight monasteries, whereof seven were for men and one for women, two stately churches and one hospital. The churches and monasteries were all richly adorned with altar-pieces and paintings, huge quantity of gold and silver, with other precious things; all which the ecclesiastics had hidden and concealed. Besides which ornaments, here were to be seen two thousand houses of magnificent and prodigious building, being all or the greatest part inhabited by merchants of that country, who are vastly rich. For the rest of the inhabitants of lesser quality and tradesmen, this city contained five thousand houses more. Here were also great number of stables, which served for the horses and mules, that carry all the plate, belonging as well to the King of Spain as to private men, towards the coast of the North Sea. The neighboring fields belonging to this city are all cultivated with fertile plantations and pleasant gardens, which afford delicious prospects to the inhabitants the whole year long.

Any one familiar with historical writing about the isthmus will have no difficulty in tracing all of it that relates to Old Panama to this source. Because Esquemeling was an eye-witness, and the only one who has written on the subject, his account has been accepted



Cathedral Plaza, Panama City, with front of cathedral, on the platform of which President Roosevelt spoke in 1906.



The flat arch in ruins of San Domingo church.

as truthful and has been passed on from one historical writer to another, each adding such embellishments as his fancy dictated. That a professional pirate with a facile pen might possibly be a facile liar few of these writers seem to have suspected. That the same pirate might naturally exaggerate the value of the booty which he and his fellow-pirates had captured seems also not to have been suspected. Yet to anyone who will give a little thought to the subject or will take the trouble to examine the site of the old city the gross improbability, not to say absurdity, of his narrative is easily apparent. The city was situated in a remote part of the wilderness of the New World. If its inhabitants possessed art treasures of the kind alleged by Esquemeling, if their churches were "richly adorned with altarpieces and paintings," they must have brought them from Spain—a journey of four thousand miles by sea and fifty to one hundred miles by mule-track through jungle, forest, and morass, and over mountain ridges. Esquemeling is careful to state that none of these art treasures were captured by the raiders, that they were hidden away or burned. If they were hidden, no one ever found them again, for no trace of them exists to this day. It is a safe assertion that they existed only in his imagination. So, too, with the "houses of cedar, of very curious and magnificent structure," and the "two thousand houses of magnificent building inhabited by vastly rich merchants," and the five thousand houses more. The city area never exceeded one hundred and fifty acres, according to the authentic documents which Mr. Sosa, with praiseworthy industry and

zeal, consulted in Spain, and contained no buildings of consequence or anything approaching "magnificence," save the few enumerated in preceding pages. It was simply a channel or clearing-house for the wealth which passed through it from the mines of Peru and other Spanish possessions in Central and South America to the King's treasuries in Spain. The houses of its merchants were doubtless of the usual modest and unpretentious type to be seen in Central and South American cities to-day, and those of its very large negro population mere cabins or shacks. Its ruins testify indubitably to the accuracy of this view. The foundations which remain of the stone buildings show the streets to have been narrow and the number of such buildings to have been comparatively few. The city, exclusive of its outlying negro or slave population, never exceeded two thousand souls. Put to the test of final proof, the tales of the city's wonderful art treasures, the wealth and luxury of its merchant princes, and the magnificence of its buildings which imaginative historical writers have been telling for more than two centuries have no other foundation than the picturesque narrative of a bold buccaneer with literary proclivities and the story-telling gift, who was as cheerfully careless of truth in describing the deeds and assessing the value of the booty captured by his band of thieves and assassins, "demons of the sea," as they had been of human life in pursuing their business of pillage and murder. His is a true "pirate's tale," one of the best in literature. To treat it as history is grotesque.



- A. Platform of the Fortress
- B. Place of the Powder Magazine.
- C. San Francisco Place. (Not marked.)
- D. Rampart of the Merced.
- E. Rampart of Jesus.
- F. Rampart of Joseph.
- G. Place of the Meat Market.
- H. Scently Box (In margin near left upper corner.)
- I. Port Hole of the Nuns.
- J. Scently Box of San Francisco
- K. Merced City Gate.
- L. Anchorage.
- M. Anchorage of the Nuns.
- N. Fort San Carlos.
- O. Port Hole of San Juan de Dios.
- P. Land Gate.
- Q. Port Hole of St. Joseph.
- R. Port Hole and Anchorage for Canoes.
- S. Powder Magazines.
- T. Ship Chandler.
- V. Site for City Hall.
- X. Royal Audience Hall, or chief seat for Governor of Colony. It was here for a time, then changed to Bogoth, then changed to Peru, when each in turn became the seat of the Vice Royalty in America.
- Z. Court Jail.
1. Arsenal.
2. Infantry Barracks.
3. The Moat.
4. Suburbs.

Plan and perspective of the City of Panama, 1688.

TRANSLATION OF INSCRIPTION. Consecrated to His Excellency Don Melchior Portocarrero Lasso de la Vega, Count Monclova, companion of the Order of Alcantara, of the Supreme Council of War, Committee of Armaments, Commissioner General of Spain, Viceroy and Lieutenant of His Majesty; Governor and Captain-General of the Kingdoms of Peru. Published by permission of the Field Marshal Don Ignacio Lopez de la Flor, late Governor and Captain-General of the Province of Costa Rica, and, made by the Castilian Don Fernando de Saavedra,

Immediately after the destruction of the old city its surviving inhabitants began to plan a new one, seeking especially a site which could be made impregnable both on land and water sides. They selected a point of volcanic rock jutting about a mile into the Bay of Panama from the foot of Ancon Hill. Here they planned a walled city, and on January 21, 1673, it was formally established by royal decree, with solemn religious ceremonies in which the head of the church in the New World marked with a white cross the spot at which construction of the new cathedral should be begun, and blessed the site of the new city. Work was begun at once on the cathedral, which stands today on Independence or Cathedral Plaza. It was upon the platform in front of it that President Amador, more than two centuries later, received President Roosevelt in November, 1906.

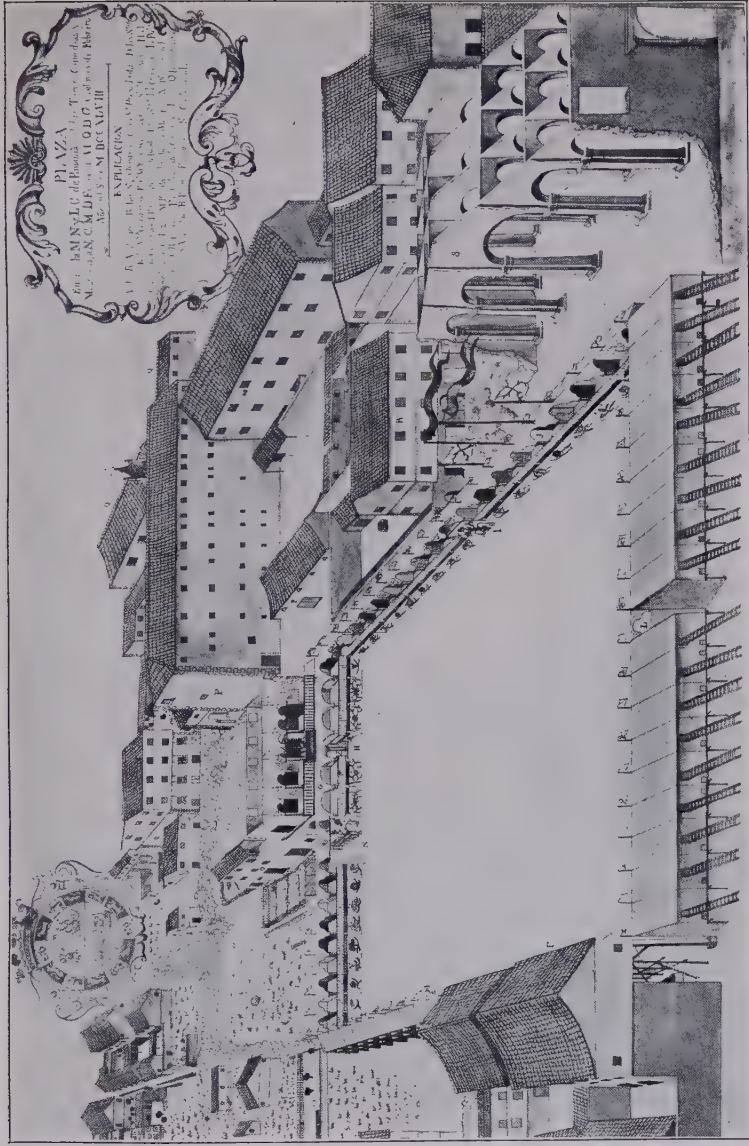
Work was begun also at once on the great wall which was to enclose the city. This was a colossal structure, varying from twenty to thirty feet in height, and in places sixty feet thick. On the sea-front was a fort or bastion commanding the approach by water, and on the landside, between the walls and the land outside, a deep moat with drawbridge and massive door, and upon the walls two bastions, with the heaviest fortifications known at the time. For the building of the wall stone was brought by water from the ruins at Old Panama. Several years were consumed in the work, and the cost is said to have reached eleven million dollars. There is a legend* that during its progress

* Some versions of this legend apply the royal remark to Cartagena, Colombia, also a walled city.

the King of Spain, who was shading his eyes with his hand and looking intently from a window of his palace at Madrid, on being asked what he was looking for, replied: "I am looking for the walls of Panama, for they have cost enough to be seen even from here!" They were designed to make the city safe against all attack, and in this they were successful.

Inside these walls, portions of which, including some on the water-front, are still standing, there were erected, in addition to the cathedral, seven churches and a college and convent, all of rubble laid in cement, much of the stone being brought from Old Panama. Most of these are still standing, though some of them are in a partial condition of ruin. In the ruins of one of them, Santo Domingo, the interior of which was destroyed by fire in 1756, there was to be seen the famous "flat arch," which excited great interest and curiosity because of its unusual construction. It was declared that no arch so flat could remain in place without mechanical aid of some sort, and it was alleged that there was a concealed beam or plank running through it. When the ruins of the church began to be removed in 1913 and the arch was examined it was found to be a genuine construction of masonry, and not a "fake."

The new city was a long time in building. An elaborate plan "in perspective" was prepared in 1688, a colored copy of which, said to be the original, is preserved in the National Institute at Panama. Through the courtesy of the director of the institute, Dr. E. G. Dexter, an American, I am able to present a photographic copy of this document, and also a like copy of



- A. Box of the members of Royal Audience Hall.
- B. Box of the Bishop.
- C. Box of the wife of the President of the Royal Audience.
- D. Box of the Oidores or Bureau of Complaints.
- E. Box of the Church functionaries.
- F. Box of the Municipality and City Officials.
- G. Box of the Managers.
- H. The Guard.
- I. The Gate to the Royal Street.
- J. Merchants' boxes.
- L. Gate to the Street of the Well.
- M. Gate to the Street of the Nuss.
- N. Gates for the bulls.
- O. Jail.
- P. School of the Society of Jesus.
- Q. Convent of the monks of St. Augustin.
- R. Episcopal Palace.
- S. Cathedral.

Plaza, 1748.

Where the municipality, nobility, and the citizens of Panama celebrated bull-fights, comedies, and masquerades in the name of Ferdinand VII, whom may God preserve, in the month of February, year of our Lord 1748.

another original plan showing the city as it really was in 1748.

The first plan shows the wall surrounding the city and the city itself as it appeared many years later. It seems quite certain that the plan was executed in substantially unchanged form. The wall was constructed on precisely the lines indicated, and parts of it, including the water-landing, marked K, still exist.

The second chart is of great interest and value as showing the slowness of the city's growth during its first three-quarters of a century. The cathedral had not passed the first stages of construction, only the foundation and arches having been placed. More rapid progress was made in the succeeding years, for the structure was completed in December, 1760, nearly eighty-eight years after its site was consecrated. It was built entirely through the efforts of one man, who devoted to the task all his energies and savings for many years. He was the son of a charcoal-burner, a poor negro, who was able to give him only a meagre education. He entered the priesthood and through his natural abilities advanced till he became bishop of Panama, the only colored man who has ever held that position.

It is evident from the size and elaborate arrangement of buildings about the bull-ring, or square, that the interest of the city centred in that. It occupied the entire central plaza, and all the main avenues of the city led up to it. It had private boxes for civic and church dignitaries, rows of boxes for merchants, and ample accommodations for the people, with outside flights of

steps leading to the seats, much in the style of a modern baseball ground. At what date the plaza was converted from a bull-ring to a park is uncertain, but probably soon after the cathedral was completed.

CHAPTER III

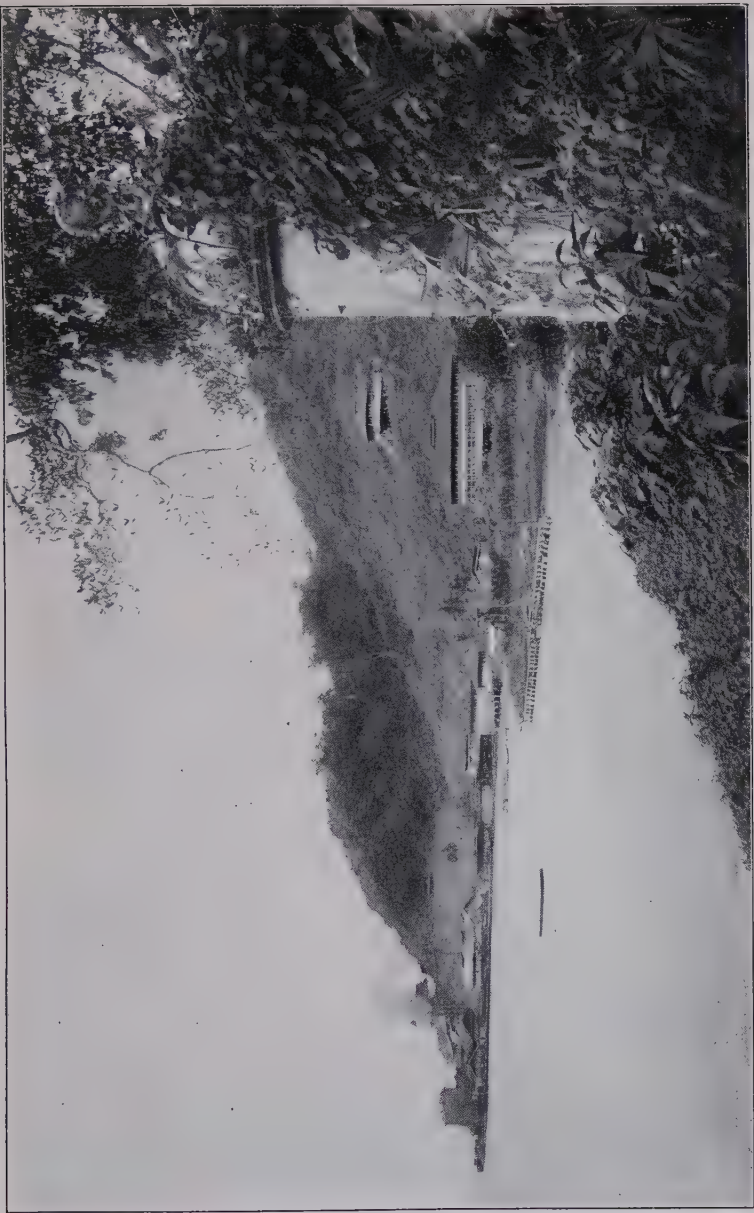
FIRST TRANSIT ROUTES ACROSS THE ISTHMUS — EARLY PROJECTS FOR A WATERWAY — THREE CENTURIES OF SPANISH RULE AND OBSTRUCTION

THE first transit route across the isthmus for the transportation of gold, silver, and merchandise from the various Spanish colonies on the Pacific to Spain ran from the city of Panama to Nombre de Dios, on the shores of the Caribbean, a distance of about ninety miles. It was cut through the forest and jungle and over mountain tops and across mountain streams, and was roughly paved with stones. It ran from Panama in a northeasterly direction for about twenty miles to a point on the Chagres River, which was given the name of Venta Cruz, changed later to Cruces. Thence it extended northward for about seventy miles to Nombre de Dios. A line of posts was established along the route. It was put in use in 1519, and was the sole route between the two oceans till about 1535, when the Chagres River between Venta Cruz and the Atlantic, a distance of about thirty-six miles, was made navigable for boats of light draught, and a water route was established between Venta Cruz and Nombre de Dios. The land route between these points was not abandoned, however, but continued to be used in con-

nection with the water route. So well was the paving laid that parts of it remain in position to-day, and the entire trail from Panama City to Cruces is open and is used by the natives as a highway for pack-mules and ponies. In 1597 Puerto Bello was substituted for Nombre de Dios as the Atlantic terminus. This town, which was situated about twenty miles northeast of the present city of Colon, and nearer to that city than Nombre de Dios by about fifteen miles, was in a bay which had been visited and given that name by Columbus in 1502. It was taken and sacked by Morgan in 1668, previous to his descent on Old Panama.* It is an interesting fact that when the American builders of the canal were in search of suitable sand and cracked stone with which to construct the locks at Gatun, they found the former at Nombre de Dios and the latter at Puerto Bello, erecting temporary quarters and machinery at both places for the purpose of securing the needed supplies.

In addition to the Panama route there were others across the isthmus at Tehuantepec and Nicaragua which at one time were of great importance. The use of these overland routes led naturally to talk about the possibility of opening a waterway between the two oceans. As early as 1529 Alvaro de Saavedra Ceron, a follower of Balboa who had made a voyage along the coast of the isthmus, proposed to connect the two oceans by a waterway, mentioning as suitable places

* Sir Francis Drake attacked it on his second freebooting expedition, but was repulsed and died of fever on board his fleet, lying off the harbor, on January 28, 1596.



The American settlement and quarry plant at Porto Bello.

View from old Spanish fort, looking seaward, December, 1911.

Panama, Nicaragua, Darien, and Tehuantepec. Each of these lines had its advocates, and from the outset there was keen rivalry between the advocates of Panama and those of Nicaragua.

Charles V, whose interest in the question was constant and keen, issued a royal decree in February, 1534, directing a survey of the lands between the Chagres River and the Pacific for the purpose of deciding as to the most effective means of establishing water communication. This is the first formal step of record toward the construction of an isthmian canal. The governor of the Panama region, Pascual Andagoya, who made the survey, reported that the work proposed was impossible, and that no king, however powerful he might be, was capable of forming a junction of the two seas or of furnishing the means of carrying out such an undertaking.

This report apparently discouraged Charles, for during the remaining twenty-two years of his reign he took no further steps in that direction. He abdicated in favor of his son Philip II in 1556, and this monarch, after directing a survey of Nicaragua in 1567, and receiving a report quite as unfavorable as that which his father had received in regard to Panama, entered upon a policy which postponed all consideration of an isthmian canal for two centuries.

The basis of this policy was the conviction that a waterway would be a menace to that monopoly of South American commerce and products, including the rich output of the gold and silver mines of Peru, which Spain was able to maintain through her control

of the land routes of the isthmus. Philip realized as fully as did Sir Walter Raleigh the value of the position held by Spain, and undoubtedly concurred in the latter's statement to Queen Elizabeth: "By seizing the Isthmus of Darien you will wrest the keys of the world from Spain." He knew that so long as the monopoly of isthmus transit remained unbroken Spain held the "keys of the world," and he not only opposed the construction of a canal on the ground that, since the Almighty had divided the two oceans, for man to unite them would be to invite Divine wrath, but also forbade, on penalty of death, the opening of new land routes. This policy was so attractive to Spain that it was continued till the end of her three hundred years of South American domination, or till the beginning of the nineteenth century. During all that time no progress whatever was made in the direction of a canal, and no information was accumulated in regard to the physical structure of the isthmus.

When Humboldt visited Central and South America, in the early part of the nineteenth century, he spoke of this lack of accurate knowledge, saying that the elevation of no mountain, plain, or city from Granada to Mexico was known. He gave conclusive evidence of his innocence of such knowledge by proposing no less than nine routes for a maritime canal, including Tehuantepec, Nicaragua, Panama, and Darien, saying he had no doubt of the practicability of construction, and that the enterprise would "immortalize a government occupied with the interests of humanity." Most of the statements which he made in regard to the phys-



Street scene in Old Porto Bello.
December, 1911.



Village of Cruces, Canal Zone.
A street scene, 1912.

ical character of the isthmus were shown by later investigations to have been mere guesses.

Humboldt's views, which were widely published, revived interest in the question of an interoceanic waterway, and in April, 1814, the Spanish Cortes passed a decree for the construction of an isthmian canal adequate for the passage of vessels of the largest size, and providing for the formation of a company to undertake the enterprise. Nothing was done under this decree. Five years later the Spanish provinces in Central and South America began to throw off the yoke of Spain, and by 1823 all of them had established their independence. With this separation from her American possessions the possibility of constructing an isthmian canal passed from Spain.

CHAPTER IV

AWAKENING OF AMERICAN INTEREST

WITH the passing of Spanish domination in Central and South America there came a general revival of interest in the subject of an isthmian waterway. For the first time the United States took official notice of the project. Scarcely had Guatemala, San Salvador, Honduras, Nicaragua, and Costa Rica formed the Federal Republic of the United Provinces of Central America, when Aaron H. Palmer, a merchant of New York City, in behalf of himself and other merchants, made formal proposals to the new federal republic for the construction of a canal through Nicaragua. Prompted by these proposals, the envoy of the federal republic at Washington was instructed to call the attention of the United States Government to the matter. This he did in a letter addressed to Henry Clay, Secretary of State, under date of February 8, 1825, stating that a company of respectable American merchants was ready to undertake the task as soon as it could be arranged by treaty between the two governments, and assuring the secretary that nothing would be more grateful to the "Republic of the Centre of America" than the co-operation of the American people in the work. Mr. Clay responded favorably, assuring the

envoy of the "deep interest taken by the government of the United States in an undertaking so highly calculated to diffuse an extensive influence on the affairs of mankind," and informing him that the President had decided to instruct the United States envoy to Central America to investigate the merits of the Nicaraguan route.

The American envoy was so instructed in 1826. There is no record of a report by him. Without waiting for action by the United States Government, the Republic of Central America entered into a contract with Palmer and his associates on June 16, 1826, for the construction of a canal, but after nearly a year of futile effort to induce capitalists to invest in the enterprise, Palmer abandoned it.

An agreement between the Central American Republic and a company in the Netherlands, in 1830, resulted in like failure. The Congress of the republic appealed to the United States again in 1835, and in Response the United States Senate, on March 3 of that year, passed a resolution requesting the President to consider the expediency of opening negotiations with the new republics of Central and South America for the purpose of protecting by suitable treaties such individuals and companies as might undertake to construct a canal, and for securing forever to all nations the free and equal right of navigating it on payment of reasonable tolls.

In accordance with this resolution President Jackson sent Charles Biddle to Nicaragua and Panama, with instructions to examine the different routes of pro-

posed communication and report, but nothing of importance resulted, and on June 9, 1837, the President sent a message to the Senate saying it was not expedient at the time to enter into negotiations with foreign governments with reference to an interoceanic canal. A year later a memorial was sent to Congress, signed by the mayor and other influential citizens of New York, setting forth the national importance of a canal and requesting that competent engineers be sent to the isthmus to investigate the various routes and report as to the most desirable. A committee report was the only outcome.

In 1839 President Van Buren sent John L. Stephens to the isthmus to investigate and report on the different routes. He recommended the Nicaraguan route, estimated the cost of a canal there at \$25,000,000, but said the time was not favorable for the enterprise because of the revolutionary condition of the country.

There were many other proposals and investigations by various persons and governments between the years 1824 and 1840, but nothing of importance resulted.

In November, 1831, New Granada, Venezuela, and Ecuador, which in 1819 had united in forming the Republic of Colombia, separated into three independent republics. As the Panama route was in the territory of New Granada, that republic had full control of it, and in 1838 it granted a concession to a French company to construct railways or canals across the isthmus, with the Pacific terminus at Panama. Several years were spent by the company in making surveys, and a statement was put forth to the effect that a depression

had been found in the mountains of the continental divide which offered a passage only about thirty-seven feet above Pacific sea-level.

This was so much in conflict with previous reports that Guizot, at the time French Minister of Foreign Affairs, sent Napoleon Garella to Panama in September, 1843, to investigate the matter. He reported that the lowest mountain-pass was about 375 feet above sea-level. He favored a lock canal, about 158 feet above sea-level, with 34 locks, 18 on the Atlantic side and 16 on the Pacific side, and proposed either a cut through the mountain range or a tunnel. The estimated cost, with a tunnel, was \$25,000,000; with an open cut, about \$28,000,000. This report was a serious disappointment, and led to the abandonment of the project and the forfeiting of the concession.

CHAPTER V

A CANAL FOR ALL NATIONS

FROM the very beginning of its active interest in an isthmus canal the United States Government contended that if such a waterway were to be opened it should be free to all nations on equal terms. In 1825, when the matter was formally presented for the first time to the United States Government, President Adams appointed Messrs. Anderson and Sergeant delegates to a congress of nations at Panama, and in his instructions to them Secretary Clay said:

A cut or canal for purposes of navigation somewhere through the Isthmus that connects the two Americas, to unite the Pacific and Atlantic oceans, will form a proper subject of consideration at the Congress. That vast object, if it should be ever accomplished, will be interesting, in a greater or less degree, to all parts of the world. But to this continent will probably accrue the largest amount of benefit from its execution; and to Colombia, Mexico, the Central Republic, Peru and the United States more than to any other of the American nations. What is to redound to the advantage of all America should be effected by common means and united exertions and should not be left to the separate and unassisted efforts of any one power. . . . If the work should ever be executed so as to admit of the pas-

sage of sea vessels from ocean to ocean, the benefits of it ought not to be exclusively appropriated to any one nation, but should be extended to all parts of the globe upon the payment of a just compensation or reasonable tolls.

In 1835 the Congress of the Republic of Central America offered to grant to the United States the right to construct a canal across the isthmus, and in response to this action the United States Senate, on March 3 of that year, passed the following resolution:

Resolved, That the President of the United States be respectfully requested to consider the expediency of opening negotiations with the Governments of other nations, and particularly with the Governments of Central America and New Granada, for the purpose of effectually protecting, by suitable treaty stipulations with them, such individuals or companies as may undertake to open a communication between the Atlantic and Pacific Oceans by the construction of a ship canal across the isthmus which connects North and South America, and of securing forever, by such stipulations, the free and equal right of navigating such canal to all such nations, on the payment of such reasonable tolls as may be established, to compensate the capitalists who may engage in such an undertaking and complete the work.

The House of Representatives took up the question four years later, 1839, and adopted unanimously a resolution in which the President was requested:

To consider the expediency of opening or continuing negotiations with the governments of other nations,

and particularly with those the territorial jurisdiction of which comprehends the Isthmus of Panama and to which the United States have accredited ministers or agents, for the purpose of ascertaining the practicability of effecting a communication between the Atlantic and Pacific Oceans by the construction of a ship canal across the Isthmus, and of securing forever, by suitable treaty stipulations, the free and equal right of navigating such canal to all nations.

Seven years later the principle of a canal for all nations was embodied, in a form which established it as the traditional policy of the United States, in a treaty with New Granada, which was concluded in December, 1846, but not ratified and proclaimed till June, 1848. In that treaty the government of New Granada granted to the government of the United States the right of free and open transit across the Isthmus of Panama upon any modes of communication then existing or that might thereafter be constructed, and in return the United States guaranteed the perfect neutrality of the isthmus, with a view that free transit from the one to the other might not be interrupted or embarrassed, and guaranteed also the rights of sovereignty and property which New Granada possessed over said territory.

In his message to Congress, transmitting this treaty for ratification, on February 10, 1847, President Polk said:

In entering into the mutual guarantees proposed by the thirty-fifth article of the treaty, neither the Government of New Granada nor that of the United States

has any narrow or exclusive views. The ultimate object, as presented by the Senate of the United States in their resolution (of March 3, 1835), to which I have already referred, is to secure to all nations the free and equal right of passage over the isthmus. If the United States, as the chief of the American nations, should first become a party to the guarantee, it cannot be doubted, indeed it is confidently expected by the Government of New Granada, that similar guarantees will be given to that Republic by Great Britain and France.

Secretary Cass, in a letter to Lord Napier, British minister to the United States, on September 10, 1857, spoke of the treaty as offering "free transit to all desiring it," on condition of such guarantee.

The Clayton-Bulwer treaty of 1850 declared the "great design of this convention" to be "that of constructing and maintaining the said canal as a ship communication between the two oceans for the benefit of mankind, on equal terms to all."

On January 14, 1869, a treaty was concluded with the United States of Colombia and sent to the Senate for ratification by President Johnson, containing a clause which read: "The Government of the United States of America shall establish a tariff of tolls and freights for the said canal on a basis of perfect equality for all nations, whether in time of peace or war."

This was not ratified. On January 26, 1870, another treaty was concluded with the same republic and sent to the Senate by President Grant, on March 31, for ratification, containing a clause authorizing the United States to establish and from time to time change and

alter a tariff "upon a basis of perfect equality at all times and among all nations." This also was not ratified, but in neither instance was objection made to the free and equal provision.

Hamilton Fish, Secretary of State, writing, on September 4, 1869, to S. A. Hurlbut, United States minister at Bogota, in reference to a canal treaty with Colombia, said:

The President (Grant) is disinclined to enter into any entanglement in participation of control over the work with other powers. He regards it as an American enterprise, which he desires to be undertaken under American auspices, to the benefit of which the whole commercial world should be fully admitted.

Secretary Evarts, writing to Ernest Dickman, American minister at Bogota, on April 19, 1880, said:

In all language that this Government has ever used, in all the action it has ever proposed, in reference to an interoceanic canal, it has expressed not only its willingness, but its anxiety that such an enterprise should be for the benefit of the world's commerce, and in no proposition that it has ever made has it sought for its citizens or its commerce special advantages.

When the question of modifying the Clayton-Bulwer treaty was under discussion in 1881, Secretary Blaine wrote, on June 24, to James Russell Lowell, American minister at London:

Nor, in time of peace, does the United States seek to have any exclusive privileges accorded to American

ships in respect to precedence or tolls, through an inter-oceanic canal any more than it has sought like privileges for American goods in transit over the Panama Railway, under the exclusive control of an American corporation. It would be our earnest desire and expectation to see the world's peaceful commerce enjoy the same just, liberal, and rational treatment.

In his annual message to Congress, in 1885, President Cleveland said:

The lapse of years has abundantly confirmed the wisdom and foresight of those earlier administrations which, long before the conditions of maritime intercourse were changed and enlarged by the progress of the age, proclaimed the vital need of interoceanic transit across the American Isthmus and consecrated it in advance to the common use of mankind by their positive declarations and through the formal obligation of treaties.

The Hay-Pauncefote treaty, abrogating and succeeding the Clayton-Bulwer treaty, was ratified on December 16, 1901. It contained this clause, which embodied, as the foregoing citations abundantly prove, the unbroken "free and equal" canal policy of the United States Government for three-quarters of a century:

The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality, so that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic, or otherwise. Such conditions and charges of traffic shall be just and equitable.

In transmitting the treaty to the Senate, President Roosevelt said in his special message:

It specifically provides that the United States alone shall do the work of building and assume the responsibility of safeguarding the canal and shall regulate its neutral use by all nations on terms of equality without the guaranty or interference of any outside nation from any quarter.

In another message sent to Congress on January 4, 1904, President Roosevelt said:

If ever a Government could be said to have received a mandate from civilization to effect an object the accomplishment of which was demanded in the interest of mankind, the United States holds that position with regard to the interoceanic canal.

This was the unbroken attitude of the United States Government down to August 24, 1912, when President Taft approved a bill* which had been passed by Congress, providing for the opening, operation, etc., of the Panama Canal, in which American ships engaged in coastwise trade were exempted from the payment of tolls. This action called out a formal protest from Great Britain, on the ground that it was a violation of the Hay-Pauncefote treaty, and the question became a subject for animated controversy on both sides of the Atlantic. In the United States there was formidable opposition to the law, and a strong demand for its repeal. The most influential newspapers of the

* Appendix C.

country were nearly or quite unanimous in favor of repeal, and popular sentiment, so far as it manifested itself through the expressions of commercial and other organizations, sustained their position. Senator Root, of New York, introduced in the Senate, on January 14, 1913, a bill repealing the exemption, but it did not reach a vote before adjournment, on March 4. The question was thus passed on by the Taft administration to that of its successor, President Wilson, who assumed office on that date.

CHAPTER VI

THE FIRST PANAMA RAILROAD

THE treaty with New Granada in 1846 was the outcome of a steadily increasing need for a better route of communication between the eastern section of the United States and its new possessions on the Pacific coast. Its negotiations were begun at the opening of an important epoch in human progress. In 1846 a treaty was concluded between Great Britain and the United States which settled the dispute between those two nations as to the boundary line west of the Rocky Mountains and in accordance with which Oregon became a territory of the United States in 1848. The war between the United States and Mexico began in May, 1846, and resulted in a treaty, signed February 2, 1848, by which California was added to the United States. Almost simultaneously with the signing of the treaty gold was discovered in California (January 24, 1848), and the demand for a transit route across the isthmus was greatly increased. The value of a right of way across it was correspondingly enhanced.

To the thousands of gold-seekers who started almost immediately from the East, haste in reaching the new gold-fields was the great desideratum. To enable them to avoid the tedious and arduous journey across the

plains and the no less tedious and arduous one around Cape Horn, steamship and packet lines were opened between New York and the Atlantic termini of the isthmus trails and between Panama and San Francisco on the Pacific. The trials and tribulations of those crossing the isthmus in this manner naturally called renewed and most insistent attention to the need of a better isthmus route, and the matter was brought before Congress in the form of a joint resolution in the House of Representatives, at the thirteenth session, 1848-9, authorizing the survey of certain routes for a canal or railway between the two oceans. The resolution was referred to a committee, which reported it back, on February 20, 1849, recommending its passage.

In the meantime three enterprising American citizens had taken the first steps, never to be retraced, in the actual construction of an isthmian railway.

The first contract for a railroad across the isthmus was granted by the government of New Granada in June, 1847, to Mateo Klein, agent and attorney for an organization in Paris called the Panama Company. This, under certain conditions, conferred upon the company, for a period of ninety-nine years, the exclusive privilege of constructing and maintaining a railway across the Isthmus of Panama, to be completed within six years. Because of the failure of the French company to secure the capital necessary its privileges lapsed in June, 1848.

In December of that year, William Henry Aspinwall, John Lloyd Stephens, and Henry Chauncey, of New York, under the name of the Panama Railroad Com-

pany, obtained from New Granada a grant which was a modified form of the Klein concession. It conferred the same exclusive privileges, declared all previous concessions of like character null and void, and was to run for forty-nine years after the completion and opening of the road to public use. The road was to be completed in six years, with the agreement that if it were found to be impracticable to complete it in that time, an extension of two years would be allowed without penalty.

A few months later, April 7, 1849, the New York Legislature passed an act incorporating the Panama Railroad Company with a capital stock of one million dollars, with privilege of increasing it to five million dollars, and liberty to begin operations when five hundred thousand dollars had been subscribed and twenty per cent of each share subscribed for had been paid in. On April 12, 1855, the Legislature passed an amendment increasing the capital stock to seven million dollars. The road is still operated under the original charter as thus amended.

Soon after the granting of the charter the Panama Railroad Company sent a party of experienced engineers, under the command of Colonel G. W. Hughes, of the United States army, to the isthmus to make a survey of the line of the road with a view to its location. In his report Colonel Hughes confirmed previous opinion as to the practicability of the road, and announced the discovery of a gap in the continental divide that was thirty-seven feet lower than any previously found.

In the meantime the company had made a contract with Colonel George M. Totten and John C. Trautwine for the construction of the road. They visited the isthmus and located the line to run from Manzanilla Island (afterward Aspinwall, now Colon) to Panama. Returning to the United States, they asked to be released from their contract on the ground that they had entered into it in ignorance of conditions on the isthmus and were unable to execute it. The company released them, took charge of construction itself, and retained them as associate engineers-in-chief.

The real pioneers of an isthmian canal were these builders of the Panama Railroad: John Lloyd Stephens, Colonel George M. Totten, John C. Trautwine, and their chief associates, James L. Baldwin and Captain John J. Williams. They cut through pestilential jungle and morass the pathway which the canal of the future was to follow. The story of their struggles with the obstacles and perils of a tropical wilderness, with sickness and death as their constant companions, is a record of American pluck and indomitable persistence rarely equalled and never surpassed in our annals.* Nothing that those who followed them in canal work, under French and American direction, were called upon to endure was comparable to what they encountered and overcame. It cost Mr. Stephens his life, and the price

* "Handbook of the Panama Railroad," Dr. F. N. Otis, New York, 1861.

"Panama in 1885," Robert Tomes, New York, 1855.

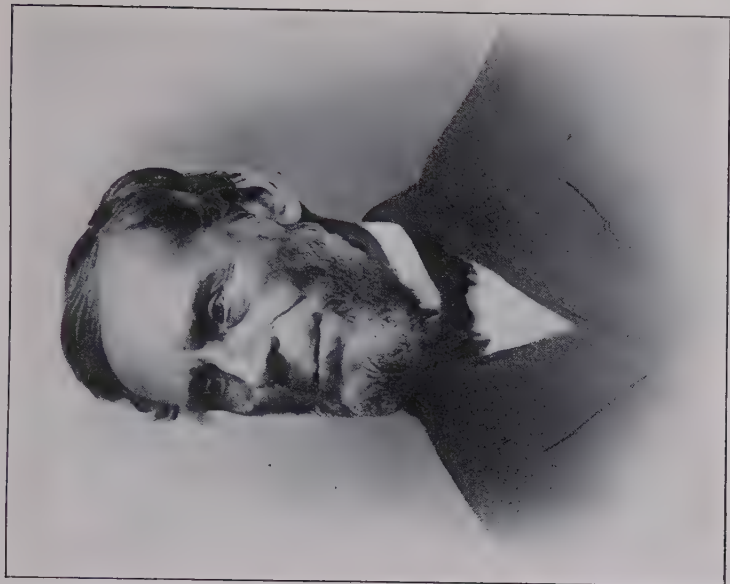
"Five Years at Panama," Dr. Wolfred Nelson, New York, 1889.

"Fifty Years at Panama, 1861-1911," Tracy Robinson, Panama, 1912.

that many of his associates paid was years of debilitating illness ending in permanent loss of health. Mr. Trautwine and Captain Baldwin retired at the end of the first year, the former because of disagreement with the directors of the company on questions of policy, and the latter because of impaired health, though he returned to the work later and continued to the end. Colonel Totten remained chief engineer in charge till the completion of the road, riding over it from ocean to ocean on the locomotive which made the first trip on January 28, 1855.

The road had cost in money about \$8,000,000. What it cost in human suffering is incalculable, and in human life mainly a matter of estimate, for no accurate record of deaths was kept. Colonel Totten, who was the best authority, placed the number at 835, divided as follows: white laborers, 295; black, 140; Chinese, about 400; in a total force of about 6,000.* There had been brought to the isthmus by the railway company about 1,000 Chinese. "Every possible care," says Otis, "had been taken which could conduce to their health and comfort. Their hill-rice, their tea and opium, in sufficient quantity to last several months, had been imported with them—they were carefully housed and attended to—and it was expected that they would prove efficient and valuable men. But they had been engaged upon the work scarcely a month before almost the entire body became infected with a melancholic, suicidal tendency, and scores of them ended their unhappy existence by their own hands. Disease broke

* L. N. B. Wyse, "Le Canal de Panama," 1885.



Colonel George M. Totten.



John C. Trautwine.

out among them and raged so fiercely that in a few weeks scarcely 200 remained." *

This incident has been made the basis of one of the most persistent of the many historic "fakes" of the isthmus. On the original line of the Panama Railroad, now under the waters of Gatun Lake, there was a station called "Matachin." It was said that this was a combination of two Spanish words, *mata*, meaning dead, and *chin*, meaning Chinaman. It was a plausible fable and commanded general belief until the discovery was made that the name, affixed to the same locality, appears upon a map published in Esquemeling's Buccaneer "Narrative," in 1678, about one hundred and seventy-five years before the Panama Railway was under construction! The word *matachin* appears in every Spanish dictionary and means "butcher," and the place was probably the headquarters of such a personage, or a slaughter-house. But so deep and abiding is the love of historic "fakes" that the "dead Chinaman" tradition lives and finds ready believers to the present day. An amusing version of it is to be found in the *Bulletin* of the French Canal Company. In the bound volume of that publication for the year 1884, there appears an elaborate article by L. Simonin on the history of the isthmus, which contains this passage: "It is said that upon the railway of the Isthmus, which is seventy-five kilometres in length, there is buried a Chinaman under each cross-tie: that would make exactly seventy-five thousand Chinamen! Ah, well! in having recourse to the statistics of the time it

* Otis, "Handbook of the Panama Railroad."

appears that two or three thousand Chinamen at most had died in a work which lasted nearly five years."

This is an amusing confusion of two favorite isthmus "fakes," the "Dead Chinaman—Matachin," and the "Dead-man-for-every-tie." In its usual form the latter does not put a defunct Chinaman under each tie, but merely says that the "Panama Railroad cost the life of a man for every tie." This is repeated by nearly every visitor to the canal, and by nearly all high medical authorities who have written upon past and present sanitary conditions on the isthmus. As there were about one hundred and fifty thousand ties on the original Panama Railway, it will be observed that as a "thriller" this version of the "fake" has doubled the capacity of the French-Chinaman version. An entirely new "fake" appeared as late as 1911, in a statement that at one time the "Panama Railway construction company imported one thousand negroes from the West Coast of Africa, and within six months these had all died off."

This is the first and only appearance in print, so far as my observation goes, of such an importation, and no record of it is to be found anywhere. If the one thousand were not imported, they could not have died. It is needless to say that if such a veritable holocaust had taken place it could not have escaped the attention of Doctor Otis and other historians of the building of the railway. It is, in fact, the most purely imaginative of all the fables connected with the project. It lifts the death total at a single bound one thousand higher than it had ever been placed before, or to about one



Scene on the old Panama Railroad, now under Gatun Lake

The tree, one of the most imposing in the Canal Zone, was known as the Stephens Tree, because of a false tradition that John L. Stephens, president of the railroad at the time of construction, died under it. He died in New York, October 10, 1852, from effects of hardships, exposure, and disease incurred on the Isthmus.

hundred and fifty-one thousand. This, in a total force of six thousand is an achievement that must rank as the supreme triumph of Direful Death. Colonel Totten's statistics, cited above, show conclusively what gross exaggerations all these inventions are.

The chief cause of illness and death was malarial fever in various forms, the worst of which was known as Chagres fever. No mention is made by Doctor Otis or any other contemporary writer of yellow fever, and there is no record of a case of it during the period of railway construction, so that there was no heavy mortality from that disease. Malarial fevers, while causing great suffering and debilitation, have a much lower percentage of deaths. That the railway working force was at times completely incapacitated by these is a matter of record. It is also a matter of record that the *anopheles* mosquitoes were the busy and swift agents of dissemination. The working force was compelled during the early months of construction to labor by day amid swarms of these insects and to sleep at night in the hull of an old brig at Colon amid other swarms of them. Dr. Otis gives harrowing accounts of the sufferings thus entailed. Mr. Trautwine, writing on January 6, 1851, to the *American Railroad Journal*, said in a long and extremely interesting letter:

At this time (May and June, 1850) no accommodation was procurable for ourselves and our workmen, except a small brig. Our laboring force was consequently very limited, and the rainy season having fully set in, converted the earth into a perfect swamp; and moreover prevented the burning of the dense forest

which we were attempting to clear. The mosquitoes and sand flies were at the same time so numerous, that it was with difficulty we could induce the laborers to continue at their work—and that only by remaining with them, in person, and aiding them during the whole day. These discomforts, together with the stifling heat and myriads of insects in the cabin and hold of our small brig, prevented other sleep than that arising from exhaustion and frequently compelled us to pass whole nights on deck, in the rain, rather than encounter the annoyances below.

There was no suspicion at that time that the mosquitoes were transmitting the fevers from one person to another, and were something worse than annoying pests. In his "Private Notes," published some years ago, Mr. Trautwine made this interesting and curious entry:

TROPICAL PRECAUTIONS

A veil over the face is a partial protection from miasmatic vapors.

Dry rooms are important. Sheet iron stoves. When camping out a large brushwood fire all night.

Keep closed such doors and windows as open to winds blowing across marshes, very important; especially to the sick. But if they must be open have screens of gauze or *copper* wire, which is better than iron, if near salt water, as it does not rust.

Mosquito nets are good, not only against insects but miasma. Bolting cloth is strongest and best.

Because there was less fever among persons protected by veils and screens, it was a natural conclusion that those barriers were excluding the miasma itself rather than the transmitters of it.

The original contract between the Panama Railroad Company and New Granada was revised in 1850, and modified in 1867, 1876, 1880, and 1891. As thus amended the contract was to run for ninety-nine years from August 16, 1867, or till August 16, 1966, during which time the company was to enjoy the exclusive privileges conferred in the original grant, and to have use and possession of all the property connected with the road and its service. In return the company was to pay an annual indemnity of two hundred and fifty thousand dollars to the Republic of Colombia. At the expiration of ninety-nine years the entire property was to revert to Colombia.

In August, 1881, the French Canal Company secured possession of the Panama Railroad through a total expenditure of about twenty-five million dollars.

Under the treaty of February 26, 1904, between the United States and the Republic of Panama all rights to the property of the Panama Railroad Company which the Republic of Panama had as a result of the transfer of sovereignty from Colombia to Panama were granted to the United States. The road thus became the property of the United States Government, which now owns all its stock.

A few years later the construction of the canal compelled the relocation, or rather abandonment, of the road, and the cutting through forest, jungle, and morass of a new one in its stead. The story of this portion of auxiliary canal work is related in another part of this volume.

CHAPTER VII

A FIFTY-YEAR OBSTACLE

IN 1850 the United States and Great Britain entered into a compact for the avowed purpose of hastening the construction of a ship-canal across the isthmus. The astonishing result was that they blocked completely for half a century every enterprise of the kind that was undertaken. They agreed, in the famous Clayton-Bulwer treaty, ratified July 5, 1850, that "it being desirable that no time should be unnecessarily lost in commencing and constructing said canal," they would "give their support and encouragement" to all efforts in that direction and would extend their joint protection over any canal or railway that might be constructed anywhere across the isthmus. They agreed that neither of them should exercise exclusive control over an isthmian canal or should fortify the same, but that they would mutually guarantee its neutrality and security and would invite other nations to co-operate with them in thus protecting it.

There were many political considerations, domestic and international, which had a controlling influence in the making of this compact, but they are not a necessary part of the present narrative.

The deadly provision of the Clayton-Bulwer treaty was that of "joint control." Between 1850 and 1860 there were many projects, all futile, for the construction of a canal. The Clayton-Bulwer treaty had been designed especially to aid the plan of a canal across Nicaragua, but it failed in this respect, and the contract of 1849 between Nicaragua and an American company for such a waterway was revoked because of the company's default, in 1856. One project after another was broached, discussed, and investigated, only to be abandoned. During the Civil War the interest of the American people was necessarily suspended, but it was reawakened soon after peace had been declared. In 1866 the Senate passed a resolution requesting the Secretary of the Navy to furnish such information as had been collected in regard to the various proposed routes for an isthmian canal. In response Secretary Welles transmitted to the Senate a report compiled by Rear-Admiral Charles H. Davis, which mentioned nineteen canal and seven railway routes on the isthmus between Tehuantepec and the Atrato River.

By this time there had developed in the United States a distinct sentiment in favor of a canal constructed and controlled by Americans. This sentiment had shown itself only slightly at the time of the ratification of the Clayton-Bulwer treaty. It found partial expression in the Senate when Senator Stephen A. Douglas, of Illinois, opposed ratification in 1850 on the ground that the United States should have no partnership with Great Britain in the control of a canal, but should have exclusive control over the

transit route and open it to the world on such terms as were compatible with American interests.*

When General Grant became President, in 1869, this sentiment had become so strong and wide-spread that it could be called properly the American doctrine in regard to an isthmian canal. Writing to S. A. Hurlbut, United States minister at Bogota, Colombia, under date of September 4, 1869, Hamilton Fish, Secretary of State, gave this interpretation of President Grant's attitude:

The President is disinclined to enter into any entanglement in participation of control over the work with other powers. He regards it as an American enterprise, which he desires to be undertaken under American auspices, to the benefit of which the whole commercial world should be fully admitted.

In his first message to Congress, in December, 1869, President Grant recommended consideration of the question of an isthmian canal. On March 13, 1872, the President, by proclamation, appointed "Brevet Major General Andrew A. Humphreys of the United States army, Professor Benjamin Pierce of Massachusetts, and Captain Daniel Ammen of the United States navy, to be Commissioners for the United States to examine and consider all surveys, plans, proposals, or suggestions of routes of communication by canal or water connection between the Atlantic and Pacific Oceans, across,

* Speech in secret session in 1850, as reported by Senator Douglas to his brother-in-law, J. Madison Cutts. in 1859. Senate Document No. 41, 2d session, 56th Congress.

over, or near the isthmus connecting North and South America, which have already been submitted, or which may be hereafter submitted to the President of the United States, during the pendency of this appointment, or which may be referred to them by the President, and to report in writing their conclusions and the result of such examination to the President of the United States with their opinion as to the probable cost and practicability of each route or plan, and such other matters in connection therewith as they may think proper and pertinent." Professor Pierce resigned in December, 1874, and on the 24th of that month the President appointed as his successor, Carlisle P. Patterson, Superintendent of the United States Coast Survey. Under the direction of this commission thorough and valuable surveys were made of the Tehuantepec, Nicaragua, and Panama routes between 1870 and 1875, the reports of which were published as congressional documents and proved of great service to subsequent canal commissions.

There was, in fact, during the eight years of President Grant's administration a great increase of public interest in a canal, with a steady consolidation of opinion in favor of the exclusive American control of such a waterway, which continued undiminished after President Hayes came into office, in 1877. When Ferdinand de Lesseps paid a personal visit to him at Washington in the spring of 1880, in the hope of getting the consent of the American Government to what he called a European control of his projected canal at Panama, President Hayes not only refused his aid, but sent, on

March 8, a special message to Congress in which he used the memorable words:

The policy of this country is a canal under American control. The United States cannot consent to the surrender of this control to any European powers.

The failure, in 1888, of the French effort at Panama, a history of which appears in another part of this volume, made it apparent that if an isthmian canal was ever constructed the work would have to be done by the United States. Experience had demonstrated that private enterprise and private capital were entirely inadequate to the task. The fixed policy of the United States Government to permit no European power, either singly or in combination with other European powers, to control a canal if one were built made it morally impossible for any of those powers to undertake the work.

After the French failure various canal projects were undertaken by Americans, the most important being that of the Maritime Canal Company of Nicaragua, which was incorporated by Act of Congress on February 7, 1899, but all of them were confronted with the "joint control" of the Clayton-Bulwer treaty, which stood squarely and immovably in the way of a canal built by Americans and controlled exclusively by Americans. Several efforts were made to have it abrogated, but none was successful till 1901. On December 16 of that year the Hay-Pauncefote treaty was ratified, superseding the Clayton-Bulwer treaty and giving the United States the right to construct a canal, and

the exclusive right of providing for its regulation and management, the canal to be free and open to the vessels of commerce and of war of all nations on terms of entire equality. It was stipulated that the canal "shall never be blockaded, nor shall any right of war be exercised nor any act of hostility be committed with it," but that the United States "shall be at liberty to maintain such military police along the canal as may be necessary to protect it against lawlessness and disorder." The United States Government has construed the last clause to mean that it may, at its discretion, fortify the canal, and it is erecting fortifications at the entrance in both oceans.

Thus the way was cleared, after fifty years of obstruction, for "an American canal, built by Americans and controlled by Americans."

PART II

**THE FRENCH EFFORT AND FAILURE
1879-1902**

PART II

THE FRENCH EFFORT AND FAILURE 1879-1902

CHAPTER I

LEADERSHIP AND METHODS OF FERDINAND DE LÉSÉPS — HIS INTERNATIONAL CONGRESS OF 1879 — PURCHASE OF THE FIRST CANAL CONCESSION

For several years after the Americans entered upon the task of opening a waterway across the isthmus there were visible from the car windows of Panama Railroad trains long rows of abandoned locomotives, dump-cars, excavating and other machinery, partially hidden by a jungle growth of creeping vines. Visitors were told that this was "old French machinery," standing where it had been left when the French company collapsed twenty years earlier. The little locomotives and cars, almost toy-like in appearance when compared with those in use by the Americans, bore eloquent testimony to the irresistible onward march of mechanical invention. Time had retired them from active service as completely as if they had never existed, leaving them stranded as mere "junk" along the wayside of progress. Covered with the softening mantle of vine and leaf and flower, and overshadowed by waving palms, they stood,

in silent dignity, as the fitting monuments of a "lost cause," making a spectacle so eloquent with the sadness of failure, the pathos of defeat, that few beholders could contemplate it unmoved, and no Frenchman could look upon it with eyes undimmed.

The story told by these silent witnesses was a true one, for the record of French effort and failure at Panama, with its mingling of folly, absurdity, greed, and heroism of the highest quality, is one of the most pathetic as it is one of the most diverting in the history of human endeavor. The project was doomed to failure from the outset, and was fairly rushed to destruction by reckless and rascally management; but it deserved to succeed because of the rare courage and patriotic devotion of the men, many of them the very flower of young France, who did the work in the field. The shame of the failure has been told by many pens, and not always with either charity or careful regard of truth; but the deeds of the men who faced pestilence and death with unflinching courage, many of them dropping into unnamed graves, have passed with slight and far from adequate mention. The Americans who have succeeded them in the task at Panama, and who have studied the results of their work, have a very high appreciation of their intelligence and zeal and the warmest admiration for their courage. They were a brave and skilled army led to pitiful disaster by incompetent and unworthy commanders.

I have said that the story of the French endeavor is one of the most diverting as well as one of the most pathetic in human annals, and this is the simple truth.

One reads the narrative in bewilderment and wonder. Through it comedy and tragedy walk hand in hand. At intervals there is presented a performance of operabouffe in a grisly setting of pestilence and death, with the leading actor, the all-powerful director of the entertainment, dancing and pirouetting in the front of the stage blissfully unconscious, apparently, of everything except his own capers. His deeds and doings fill large space in the record, and have for many years been the subject of animated and bitter controversy. Was he an enthusiast so blind as to be irresponsible, or was he so bent upon success that he was willing to adopt any means to secure it, or was he the foremost impostor of his time? The record of his proceedings may be left to supply the correct answer to these questions.

It was his success with the Suez Canal which inspired Lesseps with the ambition to score a second triumph at Panama. The completion of the Suez project in 1869, with the world-wide fame which it brought him, including the intoxicating adulation and high honors bestowed upon him by the people and government of France, came at the time when interest in the question of an isthmian waterway was at a higher point than it had attained hitherto. President Grant had widened and intensified this interest by his expressions of approval soon after taking office, in 1869, and especially by his appointment, in 1872, of an Inter-oceanic Canal Commission, with General A. A. Humphreys, Chief Engineer, United States Army, at its head, to make a thorough investigation of all explorations, surveys, etc. In no part of the world did this action

arouse keener interest than in France, for steps were under way there already to secure a concession for an isthmus canal from the republic of Colombia. The leader in this enterprise was Etienne Türr, a Hungarian by birth and a royal major-general in the Italian army, who was an intimate friend and fervent admirer of Lesseps. The plan was discussed in the International Geographical Congress at Antwerp in 1871 and in Paris in 1875. In the spring of 1876 General Türr sent Anthoine Gogorza to Colombia, where he obtained from the Colombian Government, for himself and General Türr, under date of May 28, 1876, a ninety-nine-year concession in the name of himself and General Türr, authorizing them to make a survey of the Isthmus of Darien, and, in case the survey should show the practicability of a canal without locks or tunnels, to form a company for the construction of such a canal and an auxiliary railway.

When Gogorza returned to France with this concession, General Türr organized a company styled the *Société Civile Internationale du Canal Interocéanique de Darien*. In November, 1876, this company sent Lucien Napoleon Bonaparte Wyse, a lieutenant of marines, and brother-in-law of General Türr, with a party of engineers to the isthmus to make the survey required by the Gogorza-Türr concession. Wyse returned to France in 1877, and made a second trip to Colombia in 1878, accompanied by Armand Reclus, completing the survey and obtaining from the Colombian Government, on May 22 of that year, a contract superseding and amending that obtained by Gogorza, and granting

to the society of which General Türr was the president exclusive right to construct and operate for ninety-nine years after completion a canal across the territory of Colombia, provided that in case they were to select for a route the region in which the Panama Railroad had exclusive rights an amicable arrangement should be made with that company.

A stipulation of the contract was that the route of the canal should be determined by an international commission of individuals and competent engineers, who should make a survey on the ground and report to the Colombian Government not later than 1881. A "Congrès International d'Etudes de Canal Inter-océanique" was assembled through the exertions of Ferdinand de Lesseps, at Paris, on May 15, 1879. It opened with 135 delegates, 74 of whom were French and very friendly to Lesseps, and only 42 of whom were engineers. There were 11 delegates from the United States. Lesseps presided, and among the various projects considered was that of the Wyse concession. General Türr as well as Wyse and Reclus appeared in advocacy of it.

After a fortnight's session the congress, by a vote of 78 ays, 8 noes, and 12 abstentions, declared in favor of a sea-level canal at Panama from the Bay of Panama to the Gulf of Limon. Of the American delegates, 3 voted ay, 4 abstained, and 4 were absent. Of the 78, only 20 were engineers, and only one of these had been on the Isthmus of Panama. The cost was estimated at 1,070,000,000 francs (\$214,000,000), and the least time of completion at twelve years.

On July 5, 1879, the company of which General Türr was president transferred to Lesseps all the rights acquired under the Wyse contract of 1878, which Lesseps was authorized to transfer to a canal company to be organized in such manner as he should see fit. The consideration was the payment to General Türr of 10,000,000 francs by the canal company when organized.

On August 6 and 7, 1879, Lesseps sent out circulars in Europe and America announcing the formation of the *Compagnie Universelle du Canal Interocéanique*, with a capital of 400,000,000 francs (\$80,000,000), represented by 800,000 shares at 500 francs (\$100) each. The subscription, which was opened in Europe and America, was a failure, only 30,000,000 francs (\$6,000,000) being taken. The project was bitterly assailed, and in order to overcome hostility, Lesseps ordered new surveys of the route and started in person for the isthmus, accompanied by an international technical commission of nine members, to make the survey required by the Wyse concession.

CHAPTER II

LESSEPS'S FIRST VISIT TO THE ISTHMUS — FIRST BLOWS OF PICK AND DYNAMITE

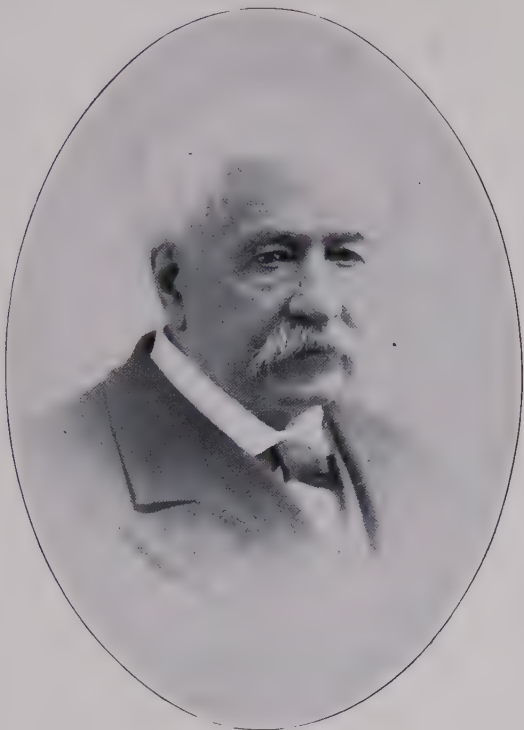
SURELY no great engineering work was ever undertaken in a more jocund spirit than Ferdinand de Lesseps exhibited when he entered upon his second task as the world's chief canal-builder. His success with the Suez Canal seemed to have turned his head so completely that all obstacles were virtually invisible to him. He was the first promoter of the age, the flamboyant collector of capital under whose seductive appeals all French purses flew open. Had he been an engineer, his appeals would necessarily have been deprived of that appearance of boundless confidence, that jaunty disregard of all difficulties, which made them so attractive and so nearly irresistible to his own people. If he saw obstacles, he refused to take cognizance of them. When trained engineers called his attention to them, he pushed them aside as unworthy of serious attention. He had cut a sea-level canal through the Isthmus of Suez, he would cut a sea-level canal through the Isthmus of Panama. He had ruled his so-called "Scientific Congress" at Paris, in 1879, carefully constituted to do his bidding, with a rod of iron, "jamming through," in a manner which would do credit to a

modern American political boss, his sea-level plans for Panama, turning a deaf ear to all arguments advanced by the few experienced engineers in that body against the feasibility of those plans, and securing adoption through the votes of delegates who were not engineers and who had never been on the Isthmus of Panama.

As soon as he had secured this prearranged approval of his plans, he established in Paris, on September 1, 1879, a fortnightly publication, called the *Bulletin du Canal Interocéanique*, which from its first issue till the final one in February, 1889, was devoted mainly to his personal glorification and the unqualified defence of all his proceedings. In it he published his circulars appealing for funds, stating at the outset his conviction that "*Le Canal de Panama sera plus facile à commencer, à terminer et à entretenir que le canal de Suez.*"

The stage having been set, the performance opened with the first visit of Lesseps to the isthmus in December, 1879. Every step of preparation, every stage of his journey, was heralded and accompanied by an unbroken blare of trumpeting in the *Bulletin*. His party comprised his wife and three children and an international technical commission of nine members. They reached the isthmus on December 30, and were joined there by a party of American visitors, guests of Lesseps, among whom were Colonel Totten, builder of the Panama Railroad, Trenor W. Park, president of that road, and Nathan Appleton, of Boston.

Lesseps was at that time in his seventy-fifth year, but alert and active and bubbling over with enthusiasm. To all questions about the proposed canal, all



Count Ferdinand de Lesseps.

Photograph taken at time of his first visit to the
Isthmus, 1879-80, in his 75th year.

suggestions of difficulties or obstacles, he replied with smiling amiability: "The canal will be made!" In fact, he began to make it at once in person. Two days after landing he conducted his guests across the isthmus from Colon to Panama to take part in an elaborately organized ceremony of striking the first blow of the pick (*le premier coup de pioche*) at the Pacific entrance of the proposed canal. A small steam-boat had been chartered for the purpose of conveying the party to the mouth of the Rio Grande, in the Bay of Panama, where the ceremony was to take place. It had been stocked liberally with provisions and champagne, and the Bishop of Panama, officials of the Colombian Government, and other distinguished personages had been invited. A reception, with much toasting, was held on board, and many of the guests were dilatory in arriving. The tide in the Bay of Panama, which has an average oscillation of about twenty-one feet, is no respecter of persons. It began to recede while the toasting and feasting were in progress, and, having a considerable distance to go, it travelled with rapidity. The result was that when the expedition finally got under way it was discovered that the steam-boat could not get within two miles of the spot chosen for the ceremony. This would have been disheartening to an ordinary master of ceremonies, but it was not a particle so to Lesseps. As for the guests, they were at the time in a condition of cheerfulness that rose superior to any disappointment. Lesseps promptly rallied them on the deck of the steam-boat, armed with a beautiful shovel and pickaxe which he had brought

from Paris for the purpose, and proceeded to address them.

He explained the heedless action of the tide, and said that while it was in a way disappointing, it really did not matter, since the proposed ceremony, being only a *simulacro*, could as well be given on ship-board as on land, and he had decided to proceed with it accordingly. A champagne-box filled with earth was then brought forward, and a young daughter of Lesseps administered the first blow of the pick to its contents, amid enthusiastic applause. The representatives of Colombia and other distinguished visitors also gave successive blows of the pick and delivered their speeches, and the venerable Bishop of Panama invoked a benediction upon the entire performance. So far as the testimony of eye-witnesses still living goes, no one giggled while this delightful opera-bouffe act was in progress. In the faithful *Bulletin* no mention of the delay or the champagne-box of earth was made, but the events of the day were set forth in the best Lesseps manner in the text of his speech over the box concluding the ceremony, which was as follows (I give the French text. Translation would so far deprive it of its theatric merits as to be little less than criminal): *

Sous l'autorité de la République des États-Unis de Colombie:

Avec la bénédiction de Monseigneur l'évêque de Panama:

En Présence du délégué du gouvernement général et de ceux des États-Unis de Colombie:

* *Bulletin du Canal Interocéanique*, Feb. 1, 1880.

Avec l'assistance des membres de la Commission technique des études définitives du Canal maritime universel interocéanique:

Il sera donné, aujourd'hui, 1^{er} janvier 1880, par Mlle. Ferdinande de Lesseps, le premier coup de pioche, sur le point qui marquera l'entrée du Canal maritime sur la côte de l'Océan Pacifique.

Tous les assistants donneront successivement leur coup de pioche, en signe de l'alliance de tous les peuples qui contribuent à l'union des deux océans, pour le bien de l'humanité.

The second act in this entertaining drama was performed a few days later, on January 10, with the neighborhood of Culebra Cut as the scene. Lesseps was accompanied on this occasion by the same distinguished party that had assisted at the first blow of the pick. A heavy charge of dynamite had been placed in advance deep in a rock near the line of the canal, and an electric battery had been connected with it. Made-moiselle Ferdinande de Lesseps was on hand to press the button. According to the faithful *Bulletin*, the operation was "perfectly successful," and all present "hailed the explosion as the beginning of an immense series of labors that should have for their termination the opening of the interoceanic canal." It was added with much gravity that the explosion showed that the "rocks were much less resistant than we had anticipated, which is a good augury of the rapidity with which the great trench will be made." It was also stated that the performance took place on the summit of Cerro de Culebra. Again the official narrative is in sad conflict with the testimony of eye-witnesses. Mr. Tracy Rob-

inson, who was a member of the local committee of reception, and was present at the time, gives in his interesting book of reminiscences* this account of the affair:

In order that the enterprise might have the blessing of Heaven and be officially inaugurated at the same time, with that gayety so dear to the French heart, a numerous audience was invited to Empire Station, on the line, to witness the good Bishop of Panama bestow his benediction upon the great undertaking; and then to see what dynamite could do in the way of blowing up a few hundred thousand cubic meters of rock and earth, along a part of the canal where tons of that explosive had been placed for the purpose.

Was it prophetic? The blessing had been pronounced, and the champagne, duly iced, was waiting to cool the swelter of that tropic sun, as soon as the explosion "went off." There the crowd stood, breathless, ears stopped, eyes blinking half in terror lest this artificial earthquake might involve general destruction. *But there was no explosion!* It wouldn't go! Then a humorous sense of relief stole upon the crowd. With one accord everybody exclaimed "Good gracious!" and hurried away, lest after all the dynamite should see fit to explode.

*"Fifty Years at Panama, 1861-1911," Tracy Robinson.

CHAPTER III

ESTIMATED COST OF THE PROPOSED CANAL — REDUCED BY LESSEPS — NO SUBSCRIPTIONS IN UNITED STATES — ABUNDANCE IN FRANCE

WHILE Lesseps was engaged in the diverting performances mentioned in the preceding chapter, the nine members of the international technical commission were making careful studies and estimates of the work and cost of his proposed canal. On February 14, about six weeks after their arrival, they made their report. The head of this commission was Colonel George M. Totten, the builder of the Panama Railway. The report, which was signed by all the members and which was a very thorough and scientific document, estimated the cost of the canal at 843,000,000 francs (\$168,500,000) and the period of construction at eight years. Lesseps took the report and on the following day set sail with it for New York. During the voyage, pursuing his regular policy of disregarding the opinions of experienced engineers, he composed a "note" on the report, in which he reduced the estimated cost of construction to 656,000,000 francs (\$131,600,000), a cool cut of about \$37,000,000, or nearly a quarter of the commission's estimate. When he reached New York he issued a circular to *Les Banquiers Américains*, in which he announced that he had fixed the capital of

his company at 600,000,000 francs (\$120,000,000), because of his "conviction" that there would be much economy in the execution of the work. In the same circular he declared that since the European capitalists who had taken part in the Suez enterprise had expressed their intention to subscribe for 300,000,000 francs of this capital, that amount had been reserved for them, leaving an equal amount for all the States of America, which had been set aside for them.

Lesseps was received with much cordiality in New York. There were many receptions and dinners in his honor, including a great banquet by the citizens of New York at Delmonico's, but there were no subscriptions to the stock of his company. He went to Washington in the hope of getting the support of the United States Government for his proposed "Isthmian Canal under European control," but was disappointed. He had an interview with President Hayes, which resulted in the President's sending to the Senate a special message avowing the principle that the "policy of this country is a canal under American control." While this message was a distinct and serious repulse to his plans, Lesseps rallied quickly from it and sent on the following day a cable message to his *Bulletin*, in Paris, saying: "*Le message du Président Hayes assure la sécurité politique du Canal.*"

From Washington he visited Boston, Chicago, San Francisco, and other American cities, receiving everywhere flattering attentions, which he described in brief and stirring cable messages to his *Bulletin* as "*une adhésion enthousiaste et unanime à notre entreprise,*" "*un*

accueil chaleureux," "*un plein succès*." But the enthusiasm, however warm, was unaccompanied by subscriptions to the capital stock of the Lesseps company, and when he sailed from New York, on April 1, 1880, for France by way of England, Holland, and Belgium, he had still in his possession the 300,000,000 francs of that stock which he had reserved for the United States.

In France it was quite another story. He made a tour of its principal cities during the summer of 1880, and aroused such enthusiastic faith in his project that when he opened his subscription, in November, for a capital of 300,000,000 francs (\$60,000,000) in 600,000 shares of 500 francs each, the stock was subscribed for twice. He announced during that tour that a firm of French contractors had offered to build the canal for 512,000,000 francs (\$102,400,000) and to complete it within eight years. The subscription was closed on December 10, and the first assembly of shareholders was held in Paris on January 31, 1881. At a second assembly, on March 3 following, the *Compagnie Universelle du Canal Interocéanique* was definitely constituted (*définitivement constituée*), with a capital of 300,000,000 francs (\$60,000,000) and with 102,230 subscribers, of whom 16,000 were women.

The great promoter was thus entering, in the jauntiest manner upon the task of constructing with a capital of \$60,000,000 a canal which, according to the estimate of its own chosen commission of engineers, was to cost \$160,000,000, and according to the lowest estimate which he himself was able to reach would cost \$131,600,000.

CHAPTER IV

WORK ON THE ISTHMUS — SECOND VISIT OF LESSEPS

THE arrival of the first detachment of the canal construction force at Panama was proclaimed by Lesseps in his best promoter manner. The detachment sailed from France for the isthmus on January 6, 1881. It was under the direction of Armand Reclus, who had surveyed the canal route with Wyse, and comprised thirty-five men, five of whom were accompanied by their wives. It arrived at Colon on January 29, and a few days later Lesseps gave out for publication in the Paris newspapers the following cable message from the isthmus, dated February 1: "*Travail commencé.*" Upon which the newspaper *La France* commented, "*Voilà de l'éloquence en peu de mots,*" and Lesseps himself, in his formal report under date of February 22, spoke of it as "*ce télégramme éloquent dans son laconisme.*"

This was pure humbug. Aside from crossing the isthmus on the Panama Railroad, responding to addresses of welcome from local Panama officials, and finding living quarters in Panama, there had been no "*travail*" of any kind. In fact, actual work in construction did not begin till nearly a year later, January 20, 1882, when the first *chantier*, or working section, was opened with formal ceremonies at Empire. In the evening

there was a banquet, followed by a ball, in the city of Panama.* Other *chantiers* were opened during the year at Culebra, Mindi, Monkey Hill (now Mount Hope), Bas Obispo, Gorgona, Cristobal, and Paraiso. On September 17 of the same year the present Ancon Hospital, on the slopes of Ancon Hill, near the Pacific terminus of the canal, was dedicated with formal exercises. It comprised at the time twelve buildings.

It had been made plain to Lesseps and his representatives on the isthmus, very soon after preparatory work began, that it was absolutely necessary for them to purchase the Panama Railroad. What with the railroad company's contract with Colombia and its own arbitrary rates and methods, it constituted an insurmountable obstacle to economic and expeditious canal construction. It had Lesseps at its mercy, and he had no choice except to purchase a controlling interest at the company's own price, which he did when he paid \$17,133,500 for 68,534 of its 70,000 shares of stock. The full significance of this "hold-up" by the railroad company is revealed when it is stated that Lesseps was compelled to pay \$250 for every share of stock the par value of which was \$100, and which at the time was barely at par. In addition, he paid the directors of the railroad company a cash bonus of \$1,102,000, bought \$7,000,000 of the company's bonds; and these

* There is an erroneous statement, published in several books on Panama, to the effect that the work was "inaugurated formally" on February 1, 1881, and that Sarah Bernhardt went to the isthmus to take part in it and gave a performance at a theatre in Panama in the evening. This is pure fiction. Sarah Bernhardt was not in Panama either in 1881 or 1882, her only visit to the isthmus being in 1886.

outlays, together with commissions, etc., brought the total cost of the railroad to the Lesseps company up to about \$25,000,000. It was an expensive introduction of the great promoter to the mysteries and possibilities of a Wall Street railway "deal."

Very little actual excavation was accomplished in 1882. The French contractors who had offered to construct the canal for 512,000,000 francs in eight years, and who had been in charge of the preliminary work, asked on December 31, 1882, to have their contract annulled, recommending a division of the work among several contractors. Lesseps consented to the annulment and appointed Jules Dingler director-general of the work. Dingler sailed for the isthmus February 6, 1883, arriving at Colon on February 27. He made a thorough examination of the route, and in an elaborate report recommended a canal with a depth of 29.5 feet and a bottom width of 72 feet, with a large dam at Gamboa to control the waters of the Chagres. The total excavation was estimated at 157,000,000 cubic yards, which was more than the estimate of the International Congress of 1879. The plan was accepted, and the work, under Dingler's direction, was divided into seven divisions and let to as many contracting companies, two of which were American, and all of which agreed to have their tasks finished before the end of 1889.

Work began on a large scale in 1883, and continued with steadily increasing activity through 1884 and 1885. In March, 1885, an insurrection occurred, during which the city of Colon, then called Aspinwall, was burned



Columbus statue on water-front, Cristobal, near Lesseps residences.

Presented to the United States of Colombia by the Empress Eugenie, and by Colombia presented to the French Canal Company, to be erected at the Atlantic entrance to the canal. Formally dedicated by Lesseps on February 24, 1886, during his second visit to the Isthmus.

and the city of Panama was threatened. Order was restored by the intervention of the United States, acting under the obligations of the treaty of 1846 with New Granada, to preserve the neutrality of the isthmus and maintain free and open transit across it. President Cleveland sent three war vessels, under command of Rear-Admiral James E. Jouett, and about five hundred marines at once to Aspinwall, thus saving the city of Panama from destruction and preventing damage to canal property and serious interruption of construction work.

Early in 1885 it became apparent that the canal company was in serious financial trouble. The cost of the work was known to be greatly in excess of the estimates, and money was not forthcoming to meet it. At a meeting of shareholders of his company, in Paris, on July 29, 1885, Lesseps postponed the completion of the canal from the end of the year 1888 till July, 1889, and admitted that the cost of construction would reach the amount fixed by the international congress of 1879—1,070,000,000 francs (\$214,000,000). At the same meeting he announced that on May 27 preceding he had asked the French Government for authority to issue lottery bonds for a loan of 600,000,000 francs (\$120,000,000). The government decided, before acting on this request, to send a special commission of its own to the isthmus to investigate conditions and report. It selected for this task Armand Rousseau, an eminent French engineer, who went to the isthmus in the latter part of 1885, and returned in February, 1886.

Lesseps then took steps to forestall the report of

the government commission by assembling a sort of commission of his own to accompany him to the isthmus. He invited representatives of the chambers of commerce of the principal cities of France, an eminent engineer from Germany and another from Holland. The party sailed from France in January, 1886, reaching Colon on February 17, where it was joined by the Duke of Sutherland and Admiral Carpenter, of the British navy; and by John Bigelow, representing the Chamber of Commerce of New York; Nathan Appleton, representing the Chamber of Commerce of Boston; and Admiral Jouett, of the United States navy.

This second visit, only a fortnight in length, was as continuously theatric as Lesseps could make it. There was an almost unbroken series of banquets and speeches, and an unrestrained flood of adulation and eulogy for Lesseps, to which the most expert contributor was Monsignor Thiel, Bishop of Costa Rica. When Panama was reached the whole city, according to the faithful *Bulletin*, waited to "render homage to the Creator of Canals."

The homage found expression in a gorgeous procession with allegorical floats; triumphal arches upon which Lesseps was acclaimed the "Genius of the Nineteenth Century," and his portrait was displayed with Glory crowning him with laurel; an obelisk in his honor and a garden of flowers into which Lesseps stepped from his carriage to receive a crown of laurel from the hands of a little girl. The line of march from the railway station to the central square of the city was "*une véritable procession triomphale.*" In the evening



By courtesy of Mr. Tracy Robinson.

Count Ferdinand de Lesseps, his second wife, and nine children.
 Photograph taken about the time of his first visit, 1879-80.



By courtesy of Mr. Tracy Robinson.

Group of Lesseps and his friends.

Taken at Cristobal at the time of the dedication of the Columbus statue, with
 Bishop Thiel, of Costa Rica, standing at the right of Lesseps.

there was a popular fête, with fireworks and illuminations, a banquet with innumerable speeches and felicitations, and a grand ball.

The tour of inspection along the line of the canal was also a "*procession triomphale*," with Lesseps in the front, usually on a prancing horse. "M. de Lesseps," says a member of the party, recorded in the *Bulletin*, "always indefatigable, held the head of the caravan. I saw him escalate at a gallop an escarpement of Culebra amid a roar of enthusiastic hurrahs from blacks and whites, astounded by so much ardor and youthfulness." There is a tradition on the isthmus that he went about in a flowing robe of gorgeous colors, like an Eastern monarch.

Delightful opera-bouffe this, but in a very grewsome setting. If Lesseps had even the most superficial knowledge of the financial condition of his company he must have known that it was on the verge of collapse. His spectacular antics on the isthmus were simply a final frantic effort to conceal the truth about the situation and raise more funds. If ever a man danced above the crater of a volcano he did during that fortnight of his last visit. He was in the eighty-first year of his age and the bodily vigor which he displayed was amazing. That he knew what he was about, knew how to succeed with his own countrymen, subsequent events were to prove.

CHAPTER V

LIFE AT PANAMA IN FRENCH DAYS—ITS PECULIARITIES, HARDSHIPS, AND PERILS—EXTRAVAGANCE AND GRAFT

THE tragic and heroic phases of the enterprise began with the arrival of the French engineering and organizing forces on the isthmus. They landed in a country which, with the exception of two cities, one on the shore of either ocean, was little more than a wilderness. Along the line of the railroad there were a few scattered villages composed of rude buildings and shacks whose population was mainly native. As for the section through which the proposed canal was to run, it was for the most part an impenetrable jungle. Throughout the entire country pestilence and the worst forms of malarial fever were epidemic. The two ocean cities, Colon and Panama, were the permanent abodes of disease, for they were without even the most elementary provisions for health protection. They had no sewers, no water supply, no sanitary appliances whatever. Their only scavengers were the huge flocks of buzzards that circled constantly above them. Colon was a collection of wooden buildings harboring a population which contained more of the dregs of humanity than could be found in any other settlement of its size on the face of the globe. Panama was superior to

Colon in its buildings, which were mostly of stone, and while the bulk of its population was mongrel—a mixture of many races, Indian, negro, Spanish, Chinese, Japanese, and others—it contained also a white element of merchants, bankers, and persons engaged in other occupations who were the dominating class. But with these elements of superiority, its sanitary condition was as bad as that of Colon, and its moral condition differed only in degree. Both cities had, in fact, all the debasing qualities of a mining camp or rude frontier town, with the usual facilities for gambling, drinking, vice, and general debauchery supplemented by tropical laxity in morals and conduct.

A graphic picture of life in Panama at this period is given in a narrative of personal experience on the isthmus, published in Paris in 1886, under the title of “Deux Ans à Panama.” Its author, H. Cermoise, was a French engineer who went to the isthmus with the third party that was sent out by the French company. He arrived on the isthmus in the spring of 1881, and was in the canal service for two years. Describing the scenes which he witnessed in the Grand Hotel at Panama on the evening of his arrival, he wrote:

A great, an enormous hall with a stone floor was the bar-room, in which all persons about the hotel were now assembled. In the centre were two billiard tables, the largest I have ever seen. They were so large that there were four balls to a game; with three it was impossible, in most of the strokes, to reach the ball to be played, lost as it was in the middle of this *steppe* of green cloth.

Beyond the billiard tables, at one end of the hall, stood one of those vast bars which are so much a part of American life.

In front of these rows of bottles with many colored labels most of the commercial business of Panama is transacted;—standing and imbibing cocktails,—always the eternal cocktail!

Afterwards, if the consumer had the time and money to lose he had only to cross the hall to find himself in a little room crowded with people, where roulette was going on.

Every diversion was there at hand in the hall of this hotel. But then it was useless to look for other pleasures. They were nowhere to be found. In this town there was neither theatre, concert nor café,—nothing, but the hall of the Grand Hotel, to which one must always return.

Oh, this roulette, how much it has cost all grades of canal employees! Its proprietor must make vast profits. Admission is absolutely free; whoever wishes may join in the play. A democratic mob representing every class of society pushes and crowds around the table. One is elbowed at the same time by a negro, almost in rags, anxiously thrusting forward his ten sous and by a portly merchant with his pockets stuffed with piastres and banknotes.

Very like a mining-town episode is the following:

Some time before our arrival on the Isthmus, on an evening when the play was especially high and furious, a band of thieves planned to rob the roulette-table. Under it they concealed a powerful petard or bomb, which they lighted at the critical moment. There was an explosion and a frightful panic. Everyone, believing that the house was blown up, rushed for the doors and



Grand Hotel, Panama.

Made administration headquarters of the French company about 1884. Used for a time as administration headquarters by Americans.



Front Street, Colon, during the flourishing French times.

windows. The lights went out. When the panic subsided it was discovered that all the stakes had disappeared under cover of the tumult.

This accident was more disagreeable than serious and the authorities paid little heed to it. But then the authorities never minded anything, letting the manager of the game take such steps as he saw fit to prevent the repetition of the occurrence. He, accordingly, surrounded himself with certain precautions which at first seemed odd to us until we understood them.

Before each turn of the wheel, at the solemn moment of "Make your plays, gentlemen!" the following dialogue took place between the chief croupier and his assistants:

"*Mira la bomba!* (Look for the bomb!)" he commanded.

A croupier immediately went down on all fours, lifted the carpet, inspected the under side of the table, reappeared and announced that he had seen no bomb.

"Very well!" gravely replied the chief croupier.

And only then, strong in this assurance, he pronounced the "Make your plays, gentlemen!"

He threw the ball. When it stopped he announced the number in three languages, as was necessary for the cosmopolite attendance with which he had to deal: "*Treinta y seis, colorado!* Thirty-six and red! *Trente-six, rouge!*"

Colon differed from Panama in having no central point for its debauchery. It had no Grand Hotel in which all its gambling, drinking, and accompanying vices were congregated, but it had a single main street, running along the water-front, which was composed

almost entirely of places in which these diversions were in full progress day and night with such abandon as to make the town uninhabitable for decent persons. It was a veritable sink of iniquity, if ever one existed. In these two centres of isthmus life, Panama and Colon, the French canal-builders found their sole places of abode outside the jungle. There was nowhere else to go for habitation or recreation. The advent of the various detachments from France, with plenty of money and generous cargoes of wines and other liquors, gave a tremendous incentive to the wild gayety of the two towns. Nothing like the supply of liquor which the French poured out upon the isthmus during the years of their occupation was ever seen there before, or has been seen there since. It was well-nigh unlimited in quantity and was sold to everybody at the prices at which it had been bought in large quantities at wholesale in France. Nothing was added for transportation across the ocean or to defray the cost of handling. Champagne, especially, was comparatively so low in price that it "flowed like water," and other wines were to be had in scarcely less profusion and cheapness. The lack of a pure water supply was doubtless the moving cause for this abundance, which was justified on the ground of health preservation, but the consequences were as deplorable as they were inevitable. The ingredients for a genuine bacchanalian orgy being supplied, the orgy naturally followed.

Money was scarcely less abundant than wine. Vast sums were sent from France to the isthmus during the first five or six years of canal work, and at least one-

half of it, according to most competent authorities, was either misapplied or stolen. The chief canal officials received enormous salaries, ranging from \$50,000 to \$100,000 a year, were allowed travelling expenses ranging from \$5 to \$50 a day, were provided with expensive residences and with fine horses and carriages. Previous to June, 1886, there was expended for office buildings and residences \$5,250,000. The residence of the director-general cost \$150,000, including a \$40,000 bath-house. He had a private railway car which cost \$42,000. In order to select a suitable carriage and horses for him a commission of seven of his assistants was sent to New York at the expense of the company to make the purchase. The hospital buildings at Ancon cost \$5,600,000 and those at Colon \$1,400,000. Stables had cost \$600,000, carriages and horses for employees, \$215,000, and \$2,700,000 had been spent for servants for employees. Three men were employed in nearly every instance to do the work of one, and all were extravagantly paid. Every house, hospital, stable or other building that was erected, nearly or quite every purchase that was made of machinery and supplies of every sort, were charged to the company at double or treble the original cost, and the surplus was divided. If there was an orgy of gambling and drinking and vice, there was in progress with it one of the most unrestrained orgies of extravagance, corruption, and "graft" that the world has ever seen. Froude scarcely overpainted the picture when he wrote, after visiting the isthmus during his tour of the West Indies in 1885-6:

In all the world there is not, perhaps, now concentrated in any single spot so much swindling and villainy, so much foul disease, such a hideous dung-heap of moral and physical abomination as in the scene of this far-famed undertaking of nineteenth-century engineering. The scene of operations is a damp, tropical jungle, intensely hot, swarming with mosquitoes, snakes, alligators, scorpions, and centipedes, the home, even as Nature made it, of yellow fever, typhus and dysentery and now made immeasurably more deadly by the multitudes of people who crowd thither.

CHAPTER VI

PESTILENCE AND DEATH — RAVAGES OF YELLOW FEVER — TESTIMONY OF EYE-WITNESSES — HEROISM OF THE MEN IN THE FIELD

BEHIND all the debauchery, extravagance, and bad management there lurked constantly the grim shadow of death. "Eat, drink, and be merry, for to-morrow you die!" This could well have been the motto to hang above the bars and gambling-tables in Colon and Panama, and in the camps amid the jungle. The most vigorous among the living to-day might be among the dead and buried to-morrow, smitten without warning by the swift and (at that time) mysterious scourge of yellow fever. It is not surprising, when one reads the authentic accounts of the ravages of this disease, that men sought to forget their peril by plunging into the wildest forms of diversion. What is surprising is that so many remained and faced the danger—faced it only to fall before it.

Estimates of the number of the French who lost their lives by this disease, mainly, vary greatly because no accurate record was kept, but it is a reasonably safe assertion that two out of every four who went from France died of it, and possibly three out of every four. It is said that many of them were induced to go to the isthmus in the first place and to remain there by the

very high salaries paid and by the opportunities for illicit gain; but this is not, in my opinion, either an adequate or a just explanation. There was something more than desire for pecuniary profit necessary to induce men to remain under the conditions which prevailed both in the working camps and in the two cities. It required no ordinary kind or degree of courage to induce a man who saw his companions fall one after another dead beside him, to continue at his post; yet this is what hundreds of Frenchmen did. To get a proper estimate of their courage and devotion, let me cite a few authentic instances of the silent and swift working of disease.

Sir Claude Coventry Mallet, at present British minister at Panama, was, in the early days of French occupation, British consul at the same place. Through love of adventure he accompanied one of the French surveying parties to the upper waters of the Chagres River. The expedition started with twenty-two men. Within a few weeks all its members except Mallet and the engineer in charge were incapacitated by disease. Twenty men went into hospital, where ten died. Mallet and the engineer in charge, a Russian named Dziembowski, returned to Panama, both in apparently unimpaired health. Dziembowski asked Mallet to advance him money with which to buy a suit of clothes, since he could get no money till his accounts had been rendered and approved. On the afternoon of the day of their return, the suit was bought and Dziembowski accepted Mallet's invitation to luncheon on the following day. The luncheon hour arrived, but the guest

did not appear. Going to the Grand Hotel in the evening Mallet inquired for Dziembowski, saying he had promised to lunch with him but had failed to appear. "Why," was the reply, "have you not heard of his death? He died of yellow fever at three o'clock this morning and was buried at six!" He had been buried in the new suit of clothes.

M. Cermeise, from whose book I have quoted on previous pages, records several equally dramatic cases. A dinner had been arranged at a field camp near Gamboa, in one instance, in honor of Henry Bionne, general secretary of the company, who was on the isthmus charged with a confidential mission.

The guests had assembled and were waiting to sit down when M. Bionne should arrive. Suddenly a lady present, who had been looking at the table with particular attention, cried out in much agitation: "We are thirteen at table!"

At this moment M. Bionne arrived. He heard her exclamation. "Be assured, madame," said he gayly, "in such a case it is the last to arrive who pays for all." And he sat down without seeming in the least disturbed by this sinister portent.

Never was there so gay, so lively a meal. M. Bionne was at his best, a delightful and witty conversationalist. He drank to our success on the Isthmus; we drank to his good luck, for in fifteen days he was to take the steamer and return to Europe.

Fifteen days later he sailed from Colon. At the end of forty-eight hours he was taken with yellow fever and died in a few days. The body was thrown into the Gulf of Mexico. He had not long delayed the payment of his debt!

Continuing, M. Cermoise gives a further history of what happened in the same camp:

Blasert had also left the camp. His wife wished to return to Europe with her children. He accompanied them to Colon, put them on board a steamer, and returned to Panama that same evening.

What could have affected him? Was it the result of the sudden change from life in the open air to that in town? At all events, the day after his return he took to his bed with yellow fever.

And he had crossed the far West and believed himself invulnerable. Certainly his moral character was above reproach. Alas! Nothing, neither strict morality nor crossing the far West, renders one invulnerable to yellow fever. Some days later the unfortunate man died like a new arrival from Europe.

He had also taken part at M. Bionne's dinner.

His wife and children, who had left him in good health, learned of his death on reaching France. That was a sad period for the administration. It seemed as though a wind of death were blowing over its employes.

After M. Bionne, Blasert; after Blasert, M. Blanchet continued the black series. He had just made an expedition on horseback into the interior of the isthmus, during which he had endured great fatigue. On his return the yellow fever declared itself, he took to his bed, and died in three days.

Perhaps the most tragic case was that of Jules Dingler, who was the first director-general of canal work on the isthmus. It was for him that the one-hundred-and-fifty-thousand-dollar residence had been erected. This was placed high upon the southern slope



“La Folie Dingler.”

[The \$150,000 residence of the first French director-general as it appeared in 1904.



French machinery in the jungle.

of Ancon Hill, overlooking La Boca, now Balboa,* and the Bay of Panama. Before he could occupy it his wife, son, and daughter died of yellow fever, within a few months of each other, and he returned to France a broken-hearted man, where he died soon afterward. The house was known for many years as "La Folie Dingler," on account of its excessive cost and rather inaccessible location. It was used for a time as a small-pox isolation house, later as barracks for Colombian troops, still later by the Americans as a quarantine detention station, and finally, in February, 1910, was razed to the ground to make room for works in connection with canal construction.

Dingler was succeeded by Léon Boyer, who arrived on the isthmus in January, 1886, and had hardly entered upon his duties when he was smitten with yellow fever, dying on May 1.

Philippe Bunau-Varilla, who was a division engineer during this period, makes many references to the ravages of yellow fever in his book on the "Past, Present, and Future" at Panama. He says the effect the disease had upon the courage and activity of the working force cannot be estimated; that the elusive and mysterious malady defied all precautions, laughed at all remedies, and that all that the most expert physicians could do for its victims was to administer palliatives whose effect was moral rather than curative.

* The name was changed to Balboa by order of President Taft, on April 30, 1909, in accordance with a suggestion by Federico Alfonso Pezet, at that time Peruvian minister at Panama. See *Canal Record*, May 5, 1909.

"Two talented engineers," he says, "Messrs. Petit and Sordillet, were sent to me from Paris to occupy posts as chiefs of division. Their coming had given me hope of a strong reinforcement, but unfortunately, arriving together, they were taken to the cemetery fifteen days later, victims of the fatal malady which had so terribly thinned the ranks of the personnel of all classes."

Speaking generally of the working force, he says:

Out of every one hundred individuals arriving on the isthmus, I can say without exaggeration that only twenty have been able to remain at their posts at the working stations, and even in that number, many who were able to present an appearance of health had lost much of their courage.

Colonel Gorgas, in an address delivered at Los Angeles, Cal., in June, 1911, gives the following instances which came within his personal knowledge:

One of the French engineers, who was still on the isthmus when we first arrived, stated that he came over with a party of seventeen young Frenchmen. In a month they had all died of yellow fever except himself. The superintendent of the railroad brought to the isthmus his three sisters; within a month they had all died of yellow fever. The mother superior of the sisters nursing in Ancon Hospital told me that she had come out with twenty-four sisters. Within a few years twenty-one had died, the most of yellow fever.

Conditions like these were calculated to try even the strongest nerves. That for eight years Frenchmen were found in considerable numbers who were willing

to fill the constantly thinning ranks is a fact of which their nation may well be proud. They kept the force recruited sufficiently to enable the work to be carried forward till funds for its prosecution were exhausted.

How many of them gave up their lives in the struggle? It is impossible to state the number accurately. The Ancon Hospital records show that during the eight years of work by the first French company 1,026 patients died of yellow fever. As the West Indian negroes are immune to yellow fever, these were all white persons, and nearly all French. Colonel Gorgas estimates that as many died of yellow fever outside the hospital as in, and places the number of victims at about 2,000. This is, of course, mere surmise, but it is not unreasonable. Neither is the supposition, quite general among those who have studied the subject carefully, that two out of every three Frenchmen who went to the isthmus died there. But there is no exact information obtainable. Lesseps, in accordance with his uniform policy, minimized or suppressed the truth, and outside the hospital rolls no records were kept. The hospital rolls show that during the eight years of the first French company's work 5,527 employees of all kinds died of various diseases. As the French contractors were charged a dollar a day for each hospital patient, only a small proportion of sick laborers were sent to them. It is not an unreasonable supposition, quite generally made, that for one who died in hospital two died outside, which would raise the total death-roll during the eight years to about 16,500. This again is mere surmise, but after carefully weighing all attain-

able evidence, it seems to me to be a plausible estimate. Colonel Gorgas, who adopted that figure for several years, raised it later to about 22,000, but his reasons for doing so, which he has not published, but which he has stated to me, do not strike me as convincing.

It is the undivided testimony of the Americans who succeeded the French that they did their work well and accomplished results which were little short of marvelous when the conditions which surrounded them are taken into consideration. It is also the opinion of those Americans that, had similar conditions prevailed when the United States undertook the task, no better, if as good, results could have been secured. The French were ignorant of the mosquito transmission of disease, for the discovery had not been made. They erected and equipped admirable hospitals, and, in their ignorance, furnished them with the means of spreading, rather than checking, disease. To protect their patients from annoyance from the hordes of ants which infest the isthmus, they placed the posts of the hospital bedsteads in bowls of water. In these bowls the deadly *stegomyia* mosquito was bred, and when a yellow-fever patient came in the mosquito fed on him and carried the germs of the pest throughout the hospital, infecting other patients. Being ignorant also that another mosquito, *anopheles*, transmitted malaria, they placed no screens in the windows and doors of hospitals and other buildings, and thus permitted the unchecked dissemination of that disease.

CHAPTER VII

RETURN OF LESSEPS TO FRANCE — COLLAPSE OF HIS COMPANY — SHOCKING REVELATIONS OF ITS FINAN- CIAL PROCEEDINGS — WORK DONE AT PANAMA — SENTENCE AND DEATH OF LESSEPS

LESSEPS sailed for France from the isthmus, after his second visit, on March 3, and on arrival declared, with customary buoyance and disregard of facts, that the situation on the isthmus was all that could be desired and that the canal would be completed in 1889. The delegates of the French chambers of commerce, docile as ever to the great promoter, made favorable reports, but nothing was heard from the eminent engineers of the party.

In the meantime the government's special commissioner, M. Rousseau, had returned and had reported that the completion of the proposed canal was impossible unless there was a change to a lock plan. Similar reports were made by two engineers in the employ of the Lesseps company, Léon Boyer, at the time its director-general on the isthmus, and L. Jacquet. Lesseps paid no heed to these reports, and refused to consent to a change of plan. He withdrew his request for authority to issue lottery bonds, and in July, 1886, obtained permission from the shareholders of his company to issue a new series of bonds.

The success of this issue, in the face of all that had been disclosed, was an astonishing proof of the hold Lesseps had upon the French people. It resulted in the sale of bonds to the value of about 354,000,000 francs or \$70,000,000. This was, however, only a temporary relief. The outflow of money was so tremendous that even Lesseps was compelled finally to give heed to the demand for a change in canal plan. At a meeting of the stockholders of the company in July, he gave out the information that a new plan was under consideration for a temporary canal with locks, which would not prevent the ultimate construction of a sea-level canal. A superior commission, appointed by him, reported in October, 1887, that such a plan was feasible, that the cost would not exceed 600,000,000 francs (\$120,000,000), and that the date of completion would not be later than 1891.

A plan was adopted which provided a lock canal at a summit level above the flood line of the Chagres River, to be supplied with water by elevating machinery. Alexandre Gustave Eiffel, known to fame a year later as the constructor of the Eiffel Tower in Paris, early in 1888 was awarded a contract for the lock construction. He pushed work on the new plan till the collapse of the Lesseps company, accomplishing very little.

In November, 1887, Lesseps again applied to the government for permission to issue lottery bonds. Permission was granted in June, 1888, and on June 26 an issue of 2,000,000 bonds was made, but only 800,000 were taken. A new issue was made on November 29,

when the 1,200,000 bonds remaining were offered; but less than 200,000 were taken. The end had come. On December 14 Lesseps petitioned the courts to appoint temporary managers of the company, which was done. The temporary managers sought to reorganize the enterprise, but were unsuccessful, and they informed the shareholders, at a general meeting on January 26, 1889, that they considered the appointment of a judicial receiver necessary. The shareholders so informed the court, and in accordance with that expression the civil court of the Seine, on February 4, appointed a receiver for the company.

When the affairs of the company were examined it appeared that about \$260,000,000 had been collected and expended. About 800,000 persons held stock of the company or obligations of some kind against it, and its treasury was empty. The official figures of receipts and expenditures, expressed in dollars, were as follows:

Receipts from all sources	\$266,000,000
Expenditures on the isthmus:	
Management and salaries	16,540,000
Excavation and construction	88,634,000
Heavy material	23,875,000
Material and articles for consumption	5,848,000
Buildings and management	15,397,000
Rents, care, etc	3,301,000
Surveys and preparatory work	275,000
Sanitary and religious service	1,836,000
Purchase of lands	950,000
Total on isthmus	\$156,656,000

Expenditures in Paris.....	\$78,140,000
Purchase Panama R.R. shares.....	18,653,000
Other purposes.....	9,235,000
Grand total of expenditures.....	\$262,684,000

The total excavation accomplished by this outlay of \$262,684,000 was, according to the records of the company, 51,031,081 cubic metres, or 66,743,551 cubic yards. The following table shows the amount of excavation claimed by the company, the maximum size of the working force, and the number of deaths recorded in the hospitals in each of the eight years of the company's operations:

YEAR	EXCAVATION, CUBIC YARDS	MAXIMUM NO. EMPLOYEES	DEATHS
1881.....		1,515	58
1882.....		5,838	125
1883.....	3,500,000	10,252	423
1884.....	9,847,556	19,243	1,232
1885.....	9,425,031	17,751	1,096
1886.....	15,438,962	15,978	955
1887.....	15,748,936	17,885	1,033
1888.....	16,605,308	16,059	605
Totals.....	70,565,793		5,527

The figures of yearly excavation given in the above table are compiled from the *Bulletin* of the company. They were revised when the company went into the hands of a receiver, and the total was brought down to 51,031,081 cubic metres, or about 66,743,551 cubic yards.

The mortality figures are those recorded in the hospital, and, as explained in the preceding chapter, are thought to be only about one-third of the actual mortality in the canal force.

The revelations which were made when the affairs of the company were investigated not only filled France with consternation and humiliation but the civilized world with amazement. Wholesale bribery of legislators and government officials in France, reckless extravagance and misuse of funds by the directors of the company, and a total disregard of legal or moral obligations of all kinds—these were the distinguishing features of the company's policy and conduct. It was shown that the chief financial agent of the company had received over 6,000,000 francs, partly as commissions on the sale of stock, partly as "expense of publicity," a euphemism for bribery of government officials. When the full exposure came the chief financial agent committed suicide. Another financial agent received nearly 4,000,000 francs for service and commissions. Charles de Lesseps, son of Ferdinand, confessed that he paid 600,000 francs to another agent "because of his great influence with the government." He paid 375,000 francs to the French Minister of Public Works, who confessed that he kept 300,000 francs of it and gave 75,000 francs to another person as reward for having tempted him to accept the bribe. The press of Paris received 1,362,000 francs for advertising the various stock subscriptions. One favored editor alone received 100,000 francs. A distinguished contractor received 12,000,000 francs for material amounting to 2,000,000

francs in value, and 6,000,000 francs for "transporting material" which was never delivered. It cost a handsome sum to convert a majority of the parliamentary committee of the Chamber of Deputies to a favorable view of the lottery project, one member receiving 500,000 francs, another 400,000, another 300,000, and others 200,000 each. The Minister of the Interior was persuaded to view the project with favor by a present of 300,000 francs. Charles de Lesseps justified his conduct in making these payments on the ground that they were absolutely necessary to protect the interests of the stockholders. Public opinion in France took a surprisingly lenient view both of his conduct and that of his father. Several years had elapsed between the collapse of the company and the trial, and the first bitterness felt by the stockholders over their loss had been softened by time. Their faith in Lesseps and in his good intentions was still strong, and they regarded him as the victim of dishonest agents and associates rather than as the responsible author of the disaster.

Lesseps and his son Charles were sentenced by the court to a fine and five years' imprisonment, and similar sentences were passed upon others of their associates. The sentence against Charles de Lesseps was annulled by the Court of Appeals. That against his father was never executed, for he was eighty-eight years old at the time, January 10, 1893, and a physical and mental wreck. He died in December following.

His last appearance in the world, according to a report published at the time, was characteristically dramatic. While he was lying ill in bed at his Paris

residence, in November, 1894, apparently unconscious and without memory, unable to move without assistance, a summons came for him to appear before the examining magistrate in the judicial inquiry which preceded the trial. In some mysterious way he got knowledge of the summons and comprehended it. He rose from his bed, demanded his clothes and his Grand Order of the Legion of Honor, dressed himself, put on the Grand Order, descended the stairs without assistance and went to the house of the magistrate. Arriving there, he made an impassioned defence of himself and the canal management. Returning to his home, he went to bed and was seized with high fever. On the following day he said to his wife: "What a terrible nightmare I have had. I imagined I was summoned before the examining magistrate! It was atrocious!" By degrees he became conscious it was not a dream, but he never spoke of the canal again.

CHAPTER VIII

NEW FRENCH CANAL COMPANY

THE task of the receiver in organizing a new canal company was made exceedingly difficult by the scandalous revelations which had followed the collapse of the first company. Public confidence in the enterprise was nearly or quite destroyed. The receiver endeavored to continue work on the isthmus, but was obliged to suspend it on May 15, 1889. Then, in order to determine the feasibility of the canal project, he selected a survey commission of five members to make thorough investigation of the exact situation on the isthmus and report. This commission sailed for the isthmus on December 10, 1889, and on May 5, 1890, rendered a report in which it was declared to be the opinion of the commission that it would be possible to complete in eight years, at a cost of 900,000,000 francs (\$180,000,000), a canal with a system of locks in groups on each slope of the continental divide; that the plant on the isthmus was in a satisfactory condition and might suffice for the completion of the canal; and that an "intuitive estimate" of the value of the plant and of the work done was 450,000,000 francs (\$90,000,000). The commission also reported that there was an excessive number of homes for employes,

there being accommodations for a force of 27,000 men.

The Wyse concession, under which the Lesseps company had been working, fixed the date of canal completion at twelve years after the formation of the company—or 1893. In order to continue the work it was necessary to obtain from Colombia an extension, and Mr. Wyse was sent to Bogota by the receiver in July, 1890, to secure it. In December following Colombia passed a law granting an extension of ten years, provided a new company should be formed and work on the canal begun on or before February 28, 1893. This condition not having been complied with, a second extension of ten years was sought and obtained on April 4, 1893, beginning not later than October 31, 1894. On April 26, 1900, a third extension was granted, placing the date of completion at October 31, 1910.

All legal and other obstacles in the way of a new company were cleared away during 1891, 1892, 1893, and the first part of 1894, and on October 20, 1894, the new company was definitely established with a capital stock of 65,000,000 francs in shares of 100 francs each, 600,000 shares of which had been subscribed for, and 50,000 shares were given as full-paid stock to the Colombian Government. The cash capital of the company was thus 60,000,000 francs (\$12,000,000).

Immediately following its organization the new company took possession of the property and resumed the work of construction on the isthmus, having assembled, by the end of 1894, a working force of about one thousand men.

Early in 1896 the new company appointed an international technical commission of fourteen members to make a thorough examination of the situation on the isthmus and report with recommendations. This commission, which was organized in February, 1896, was composed of seven Frenchmen, two Americans, two Germans, one Russian, one Belgian, and one Colombian, all engineers of experience and established reputation. They devoted nearly three years to the most thorough and intelligent study that had yet been made of the subject, and stated their conclusions in an elaborate and valuable report on November 16, 1893.

They recommended the construction of a canal with two levels above sea-level, with four locks on each slope, and with dams at Bohio and Alhajuela. It was to have a depth of 29.5 feet, a bottom width of 98 feet, and the lock chambers were to be 782 feet long and 32 feet wide. The cost was estimated at \$102,000,000, and the time of completion ten years. This plan was approved by the special engineering commission of the company, who reported in 1899 that it was feasible and that the proposed canal could be built for the sum estimated and within the time named.

Work, which had been carried forward since its resumption in 1893 mainly in the Culebra Cut, with a view to usefulness under any type of canal, was continued in accordance with the new plan till the transfer of the rights and property of the company to the United States on May 4, 1904. During this period the force varied from 700 to 4,000 men, touching the highest point in 1897. At the time of the transfer to the United

States it comprised about 700 men. The total excavation by the new company was 11,403,409 cubic yards, bringing the grand total of the two French companies up to 78,146,960 cubic yards. The number of deaths recorded in the hospital between 1889 and 1893, both inclusive, the period during which work was suspended and the force was small, was 199; the number between 1894 and 1904, during the operations of the new company, was 557, making the total hospital mortality between 1881 and 1904, the full period of French occupation, 6,283. Taking this as about one-third of the actual mortality during the thirteen years, the grand total would be about 18,000.

PART III

AMERICAN PURCHASE AND CONTROL

1902-1904

PART III

AMERICAN PURCHASE AND CONTROL 1902-1904

CHAPTER I

CONTEST BETWEEN NICARAGUA AND PANAMA ROUTES — DECISION IN FAVOR OF THE LATTER

WHILE the efforts of the French companies to construct a canal were culminating in final failure, an animated campaign was in progress in the United States between the advocates of the Nicaragua route and those of the Panama. Acting under the charter granted by Congress in February, 1889, the Maritime Canal Company was organized on May 9 following, with a capital of \$250,000,000, and in March, 1900, a sub-organization, called a construction company, was formed with a capital stock of \$12,000,000, the shares of which were sold at 50 per cent discount, netting \$6,000,000.

Work was begun in Nicaragua in June, 1890, and continued for three years, during which time the \$6,000,000 capital was exhausted, and the company went into the hands of a receiver. Repeated efforts were made to induce Congress to authorize the government to purchase the rights and property of the company and assume its indebtedness, but without success.

Several commissions were appointed to investigate the situation at Nicaragua, but nothing resulted from their reports. On March 3, 1899, President McKinley appointed a commission of nine members,* with Rear-Admiral J. G. Walker at its head, to make thorough investigation of all routes for a canal across the isthmus, particularly those at Nicaragua and Panama, and report as to which was the "most feasible and practicable route" for a "canal under the control, management, and ownership of the United States." This commission made its report on November 16, 1901. After an elaborate and exhaustive discussion of the two routes, the commission concluded by saying that its estimate of the cost of constructing a canal at Nicaragua was \$189,864,062, and of a canal at Panama was \$144,233,000; that the new Panama Canal company offered to sell its rights, property, and franchises for \$109,141,500, which would bring the cost of a canal by the Panama route up to \$253,374,858; that the commission estimated the value of the new Panama Canal company's property at \$40,000,000; and that, in view of the terms offered by that company, the commission was of the opinion that the "most practicable and feasible route" was by way of Nicaragua.

This report was transmitted to Congress by President Roosevelt on December 4, 1901. On January 4, 1902, the president of the new Panama Canal company sent word by cable from Paris to Rear-Admiral Walker that the company was willing to sell its properties and concessions to the United States Government

* Appendix A.

for \$40,000,000. On January 18 the Walker commission rendered to President Roosevelt a supplementary report, transmitting the offer of the French company to sell for \$40,000,000, and declaring it to be the commission's opinion, in view of the changed conditions, that the "most practicable and feasible route" for a canal was that by way of Panama.

In the meantime, while these negotiations with the French company were in progress, the House of Representatives, on January 8, 1902, passed by a vote of 225 to 25 a bill authorizing the President to proceed with the construction of a canal by way of Nicaragua, at a cost of \$180,000,000, and appropriating \$10,000,000 on account for immediate use. When the bill reached the Senate it encountered vigorous opposition. The supplementary report of the Walker commission was sent to Congress on January 20, and proved to be the doom of the Nicaraguan project. An amendment to the House bill was offered by Senator Spooner which converted it virtually into a new measure.

After a long debate, marked at times by some animosity, the Spooner bill passed the Senate on June 19, 1902, by a vote of 67 to 6, and passed the House of Representatives on June 26 by a vote of 259 to 8. It was signed by President Roosevelt on June 28. In substance it authorized the President to acquire for and in behalf of the United States, at a cost not exceeding \$40,000,000, all the rights, privileges, franchises, concessions, and property on the Isthmus of Panama owned by the new Panama Canal company; to acquire from the Republic of Colombia, on such terms as he might deem reason-

able, control of a strip of land, not less than six miles in width, between the two oceans, in which to construct and operate a canal; to acquire such additional territory and rights from Colombia as in his judgment would facilitate the general purpose; and, when a satisfactory title had been secured from the new Panama Canal company, to proceed to construct a canal of sufficient capacity and depth to afford "convenient passage for vessels of the largest tonnage and greatest draft now in use, and such as may be reasonably anticipated." In case satisfactory title could not be obtained from the French company, the act authorized the President to take the necessary steps to permit of the construction of a canal at Nicaragua. A preliminary appropriation of \$10,000,000 was made toward the project by either route. Further appropriation of \$135,000,000 was authorized in case the Panama route was chosen, and \$180,000,000 in case the Nicaraguan was the choice. To enable him to construct the canal, the President was authorized to appoint a commission of seven members, subject to approval by the Senate, to serve till the completion of the canal unless sooner removed by him, and to be in all matters subject to his direction and control. He was to fix their compensation until otherwise provided by Congress. At least four of the commissioners must be "persons learned and skilled in the science of engineering," and of these four, at least one an officer, active or retired, of the United States army, and at least one an officer, active or retired, of the United States navy.

The next step was the conclusion of a treaty between

the United States and Colombia, in accordance with the requirements of the Spooner law, and on this hung events of momentous and far-reaching importance which will be described in detail in other chapters.

CHAPTER II

COLOMBIA'S REJECTION OF THE HAY-HERRAN TREATY

IMMEDIATELY following the enactment of the Spooner law, negotiations were opened between the United States Government and that of Colombia for the conclusion of a treaty in accordance with the terms of that law. They were conducted by John Hay, Secretary of State of the United States, and Doctor Tomas Herran, chargé d'affaires of the Colombian Government at Washington. They resulted in what is known as the Hay-Herran convention, which was signed on January 22, 1903, Doctor Herran signing with the authority of the Colombian Government. It was sent to the Senate on January 23, and was ratified without change on March 17. It authorized the new Panama Canal company to sell and transfer to the United States all its rights, privileges, properties, and concessions, as well as the Panama Railroad; ceded to the United States for the purpose of canal construction a strip of land thirty miles in width between the two oceans, over which the United States should have administrative control for police and sanitation purposes, but of which the sovereignty should remain vested in Colombia; stipulated that upon the exchange of ratifications, the United States should pay to Colom-

bia \$10,000,000 in gold, and, in addition, beginning nine years after the date of ratification, should pay annually \$250,000 in gold. It was pointed out by Secretary Hay, after the rejection of the treaty by Colombia, that the bonus of \$10,000,000 was a sum equivalent to two-thirds of what was reputed to be the Colombian public debt, and that the annual payment of \$250,000 was equivalent to the interest on \$15,000,000 at the rate at which loans could be obtained by the American Government.

The Colombian Congress met in extra session, convened for the purpose of considering the treaty, on June 20, 1903. It was known that a large majority of its members were opposed to ratification, and that the Colombian Government controlled it absolutely. The treaty itself was withheld on a pretext that it must be signed by the Vice-President before being sent to the Congress. In the meantime a general clamor was raised for more favorable terms for Colombia and for amendments that should grant them.

On June 10 the agent of the new Panama Canal company at Bogota received from the Colombian Government an official note saying that it did not think the convention would be ratified, because of the opinion that the compensation was insufficient, but that, if the canal company would pay to Colombia \$10,000,000, ratification could be secured.

On July 9 General Rafael Reyes, spokesman of the government, requested the American minister at Bogota to say to Secretary Hay, as the minister did at once by cable, that he (Reyes) did not think the treaty

could be ratified without two amendments—one stipulating the payment of \$10,000,000 gold by the new Panama Canal company for the right to transfer its isthmus property to the United States, and the other increasing the bonus which the United States was to pay to Colombia from \$10,000,000 to \$15,000,000. These direct attempts to extort more money as the price of ratification were unsuccessful. Secretary Hay replied, on July 13, that neither of the proposed amendments would stand any chance of acceptance by the Senate, while any amendment whatever or unnecessary delay in ratification of the treaty would greatly imperil its consummation.

Two days later, July 15, the treaty was submitted to a special committee of nine in the Colombian Senate. It was reported to the Senate on August 4 with a series of amendments which completely changed the character of the treaty. On July 31 Secretary Hay sent the following cable message to the American minister at Bogota:

Instructions heretofore sent to you show the great danger of amending the treaty. This government has no right or competence to covenant with Colombia to impose new financial obligations upon canal company and the President would not submit to our Senate any amendment in that sense, but would treat it as voiding the negotiation and bringing about a failure to conclude a satisfactory treaty with Colombia. No additional payment by the United States can hope for approval by the United States Senate, while any amendment whatever requiring reconsideration by that body would most certainly imperil its consummation.

The substance of this message was communicated at once to the Colombian Government. On August 12 the Colombian Senate rejected the treaty in its entirety by unanimous vote. On the same date General Reyes called upon the American minister and informed him that the treaty had been rejected in accordance with a plan which had been perfected by the Colombian Government and leading senators in the belief that there would be a reaction in public sentiment in its favor, when it would be possible to reconsider and ratify it without amendment. He requested the American minister to ask the American Government to grant two more weeks for the consummation of this plan. In response Secretary Hay cabled on August 24: "The President will make no engagement on the canal matter, but I regard it as improbable that any definite action will be taken within two weeks." On August 29, Secretary Hay cabled again as follows:

The President is bound by the Isthmian Canal statute, commonly called the Spooner law. By its provisions he is given a reasonable time to arrange a satisfactory treaty with Colombia. When, in his judgment, the reasonable time has expired, and he has not been able to make a satisfactory arrangement as to the Panama route, he will then proceed to carry into effect the alternative of the statute. Meantime the President will enter into no engagement restraining his freedom of action under the statute.

On September 5 the Senate special committee reported a bill approving the rejection of the treaty and authorizing the President of Colombia to conclude

treaties for the construction of a Panama canal under certain conditions, and on terms most generous to Colombia, but the measure never came to a vote. It was referred to a committee that made a report on October 14, which was read in the Senate and which presented, without approval or dissent, a contention that the last extension of the Wyse concession, granted by Colombia in 1900, fixing October 31, 1910, as the date for completion of the canal, was not valid, and that if this was the case, the previous extension would expire at the end of 1904 and all canal properties, rights, and franchises would revert to Colombia. Colombia would then be in position to receive the \$40,000,000 which the treaty proposed the United States should pay to the new Panama Canal company, as well as the \$10,000,000 bonus, and also be in more advantageous position for demanding terms from the United States. This plan found great favor, and it was even contended that the Colombia Congress had full power to annul the extension in case it saw fit to do so. No action was taken on the report, and on October 31 the Congress adjourned, with the air of Bogota alive with rumors of impending revolution at Panama.

CHAPTER III

THE PANAMA REVOLUTION

THE Colombian Congress had scarcely been convened in special session, on June 20, 1903, when notice was served upon the Colombian Government that if the Hay-Herran treaty were rejected the department or state of Panama would revolt. On June 9 Secretary Hay sent a cable message to the American minister at Bogota, in which he said, in reference to Colombian proposals to amend the treaty, that the Colombian Government "apparently does not appreciate the gravity of the situation," that the treaty embodied the propositions presented by Colombia with slight modifications, and that if Colombia should now reject it the "friendly understanding between the two countries would be so seriously compromised that action might be taken by the Congress next winter which every friend of Colombia would regret." The substance of this message was communicated at once to the Colombian Government. On July 5 the American minister sent the following cable message to Secretary Hay:

Confidential. Have received information privately that a paraphrase of your cipher telegram of June 9

was read in the Senate secret session. Created sensation. Construed by many as threat of direct retaliation against Colombia in case the treaty is not ratified. *This, and the statement of just arrived members of Congress from Panama that this department would revolt if the treaty is not ratified*, caused alarm, and the effect is favorable.

The treaty was rejected by the Senate on August 12, and three days later the American minister, in a letter to Secretary Hay, describing the situation, wrote: "The Panama representatives have lately become so thoroughly imbued with the idea of an independent republic that they have been more or less indifferent to the fate of the treaty." On August 31, the American minister sent a cable message to Secretary Hay in which he said that Senator José Domingo de Obaldia, who had been appointed governor of Panama, had informed him that in accepting the position he had told the Colombian President that "in case the department found it necessary to revolt to secure canal he would stand by Panama." In another message, on September 10, the American minister said: "The appointment of Obaldia is regarded as the forerunner of separation," and in a letter on the following day he wrote:

Senator Obaldia's separatist tendencies are well known, and he is reported to have said that, should the canal treaty not pass, the department of Panama would declare its independence, and would be right in doing so. That these are his opinions there is, of course, no doubt.

Again, on October 21, the American minister wrote to Secretary Hay:

I have the honor to inform you that there is no disguising the alarm existing as to the possible action of the government of the United States should the feeling of dissatisfaction undoubtedly existing in the department of Panama find expression in overt acts.

The Colombian Congress adjourned on October 31, and on the same day the American minister cabled to Secretary Hay: "The people here in great anxiety over conflicting reports of secession movements in the Cauca and Panama."

In the United States the possibility of a revolution in Panama, in case of the rejection of the treaty, was a matter of public knowledge in August, 1903. Toward the end of that month the newspapers began to publish information in various forms from the isthmus and Bogota similar to that quoted above from the files of the State Department. Toward the end of October it was announced in the American press that the Colombian Government had already begun the movement of troops to the isthmus. On October 15 the President was informed by Commander John Hubbard, of the navy, that a revolution had broken out in the department of Cauca, and on the following day, at the request of Lieutenant-General Young, of the United States army, the President received two officers of the navy who had just returned by way of Panama from a four months' trip in Venezuela and Colombia. They informed him that a revolutionary party was organiz-

ing in Panama with the object of separation from Colombia, and was collecting arms and ammunition, and that it was the general belief on the isthmus that failure on the part of Colombia to ratify the treaty would lead to immediate revolution.

In view of this condition of affairs, President Roosevelt, acting in accordance with the unbroken policy of the government since the ratification of the treaty of 1846 with New Granada, directed the Navy Department to issue such instructions as would insure having American naval vessels within easy reach of the isthmus in the event of disorder there. Orders were issued on October 19 for one ship, the *Boston*, to proceed to San Juan del Sur, Nicaragua; to another, the *Atlanta*, to proceed to Guantanamo, Cuba; and to a third, the *Dixie*, to prepare to sail from League Island. On October 30 a fourth, the *Nashville*, Commander Hubbard, was ordered to proceed to Colon. On November 2, when it was evident that an outbreak was imminent, instructions were sent to the *Nashville*, *Boston*, and *Dixie* as follows:

Maintain free and uninterrupted transit. If interruption is threatened by armed force, occupy the line of railroad. Prevent landing of any armed force, either government or insurgent, at any point within 50 miles of Panama. Government force reported approaching Isthmus in vessels. Prevent their landing if, in your judgment, the landing would precipitate a conflict.

Instructions similar to these had been issued repeatedly during previous disorders of various kinds on

the isthmus, the latest instance being in September, 1902, when, as in 1856, 1860, 1861, 1862, 1873, 1885, and in 1901, sailors and marines from United States war-ships were landed to patrol the isthmus to protect life and property and keep transit free and open. In most of these instances the troops had been landed at the request of the Colombian Government.

The *Nashville* arrived at Colon at 5.30 P. M. on November 2. At daylight on the following morning Commander Hubbard learned that a Colombian gun-boat, *Cartagena*, had come in during the night with four hundred or five hundred troops on board. He had her boarded and learned that the troops were for the garrison at Panama. As he had not yet received instructions, he did not feel justified in preventing their landing, and they were disembarked at 8.30 A. M. Their commanding officers, Generals Amaya and Tovar, with four others, took the train to Panama, leaving Colonel Torres in command. At 10.30 Commander Hubbard received the cable message with the instructions cited above, and at once went ashore. Late in the afternoon he learned that there had been a revolution in Panama; that Generals Amaya and Tovar and the other four Colombian officers had been seized and were held as prisoners; that a provisional government had been established and a military force of one thousand five hundred men had been organized; and that the provisional government wished the Colombian troops at Colon to be sent to Panama.

The general superintendent of the Panama Railroad had agreed to transport the Colombian troops, but

Commander Hubbard, on the morning of November 4, prohibited the transportation of troops in either direction in order to preserve the neutrality of the isthmus and free and uninterrupted transit. During the forenoon of November 4 Commander Hubbard was informed that Colonel Torres had sent word to the United States consul at Colon that if Generals Amaya and Tovar and the other Colombian officers who had been seized at Panama were not released by 2 P. M. he, Torres, would open fire on the town of Colon and kill every United States citizen in the place. Commander Hubbard had all the American citizens of Colon assembled in the stone building of the Panama Railroad, quickly fortified it as much as possible, and at 1.30 P. M. landed forty-two men from the *Nashville* to protect the building, with orders not to fire unless fired upon. The American women and children were placed aboard a Panama Railroad steamer and a German steamer which were lying at the wharf.

The Colombians surrounded the railroad building soon after the Americans had taken possession of it, and tried to provoke attack from the American troops, but the latter were cool and steady and the effort failed.

At about 3.15 P. M. Colonel Torres entered the building for an interview, declaring that the whole affair was a misapprehension, that he was most friendly to Americans, and saying that he should like to send the alcalde of Colon to Panama to see General Tovar and have him direct a discontinuance of a show of force. This request was granted and a special train over the

Panama Railroad was supplied by the general superintendent for the alcalde's journey. At about 5.30 Colonel Torres stated to Commander Hubbard that he would withdraw his Colombian troops to Monkey Hill, about two miles outside of Colon, on condition that the American troops should be withdrawn to the *Nashville*. This proposition was accepted and faithfully complied with by Commander Hubbard. On the morning of November 5 Commander Hubbard discovered that Colonel Torres had not withdrawn his troops to Monkey Hill, but only to some buildings near the outskirts of the town, giving a trivial excuse for failure to keep his word. Learning that it was the purpose of Colonel Torres, in case he did not receive orders from General Tovar to withdraw, to bring in his troops and occupy Colon, Commander Hubbard again landed an armed force, reoccupied the railroad building, brought ashore two one-pounder guns, and mounted them in position of defence near the building. In company with the United States consul he then sought and obtained an interview with Colonel Torres, in which he told him that he had relanded his troops because of his, Torres's, failure to keep his agreement; that his sole purpose in landing them was to preserve the lives and property of American citizens; that his attitude was one of strict neutrality; that the troops of neither side should be transported; and that free and uninterrupted transit should be maintained, if necessary by force.

He tried to induce Colonel Torres to withdraw to Monkey Hill, but the latter replied that it was un-

healthy out there. Later in the forenoon of November 5 the alcalde returned from Panama without orders, and Colonel Torres marched his Colombian troops again into Colon, but they made no threatening demonstrations. During the afternoon representatives of the new Panama Government succeeded in persuading Colonel Torres to embark with his troops on a Royal Mail steamer, *Orinoco*, and sail to Cartagena. The gun-boat *Cartagena*, on which he had come to Colon, had left port immediately after the threat against Americans had been made, on November 4.

In the meantime, while the American naval officer was preventing bloodshed at Colon, the new Panama Republic was becoming established on the other side of the isthmus. As early as August, 1903, a junta of six men had been named by advocates of separation in Panama to take the leadership in plans for securing independence. It had been decided first to have the revolution on September 22, the date set for the adjournment of the Colombian Congress. When adjournment was delayed till October 31, preparations were made to have the revolution take place on November 4. The arrival of the Colombian troops at Colon on November 3 forced the event forward twenty-four hours.

The Colombian generals arrived in Panama about 11 o'clock on the morning of November 4 and were received with courtesy by the authorities and the populace. Later, when they had got wind of the impending revolution, they started for the government barracks on the sea-wall to call out the troops and signal to three Colombian gun-boats that were lying in the bay, in

the hope of frustrating the plans of the revolutionists. On their arrival they were met by General Esteban Huertas, in command of the garrison, who was in league with the revolutionists, who ordered out a company of soldiers and arrested them as prisoners of war. Governor Obaldia, the Colombian head of the department of Panama, was also arrested, as a mere formal act of deposition, but was released immediately. The three Colombian gun-boats were informed by signal that the revolution had been effected, it being supposed that they would acquiesce in it. Two of them did, but the commanding officer of the third sent official word to the chief of police that unless the imprisoned Colombian officers were set at liberty within two hours he would shell the city. At the expiration of that time he fired two shells, one of which killed a Chinaman on the street near the barracks, but when fire was opened upon the vessel from the fortifications she steamed away, never to return.

On the following morning the two remaining gun-boats ran up the flag of the new Panama Republic. With the exception of the Chinaman's death the revolution was bloodless.

CHAPTER IV

THE REPUBLIC OF PANAMA

THE formal declaration of independence was made on November 4. The municipal council of the city of Panama met and after a free discussion voted unanimously in favor of separation from Colombia and the creation of the free and independent Republic of Panama. Pending the formation of the new republic, the direction of affairs was placed in the hands of three men, who later, with eleven others, constituted the Committee of Provisional Government. At 3 p. m. on the same day a formal declaration of independence was read at a mass-meeting in Cathedral Plaza.

Generals Amaya and Tovar, with their associates, were released on November 5, on pledge of leaving the isthmus as soon as possible. They were given a military escort to Colon, but arrived there too late to sail with Colonel Torres and the Colombian troops on board the Royal Mail steamer *Orinoco*, but they took passage for Cartagena on November 12.

The *Dixie*, with a force of about four hundred men, entered the harbor of Colon at 7 p. m. in the evening of November 5, just as the *Orinoco* was sailing away. On the following morning the *Atlanta* arrived, bringing the combined American force at Colon up to about

one thousand men. The *Maine* arrived a few days later. The *Boston* arrived at Panama on November 7, and was joined there later by three other naval vessels.

On November 7 the American minister at Bogota sent a cable message to Secretary Hay, saying that General Reyes was about to start for Panama with full powers, and wished to be informed by the Secretary before starting if the American commander at Panama would be ordered to co-operate with him and with the new Panama Government to arrange peace and approval of the treaty, which would be accepted on condition that the integrity of Colombia be preserved. On the same day the Colombian Government asked to be informed through the American minister whether it would be allowed to land troops at Colon and Panama to fight there and along the line of the railway.

These messages were received at Washington on November 10, and on the following day Secretary Hay replied that it "is not thought desirable to permit landing of Colombian troops on Isthmus, as such a course would precipitate civil war and disturb for an indefinite period the free transit which we are pledged to protect."

The Republic of Panama was formally recognized by the United States on November 6 in the following message from Secretary Hay to the consulate-general at Panama:

The people of Panama having by an apparently unanimous movement dissolved their political connection with the Republic of Colombia and resumed their independence, and having adopted a government of

their own, republican in form, with which the Government of the United States of America has entered into relations, the President of the United States, in accordance with the ties of friendship which have so long and so happily existed between the respective nations, most earnestly commends to the governments of Colombia and of Panama the peaceful and equitable settlement of all questions at issue between them. He holds that he is bound, not merely by treaty obligations, but by the interests of civilisation, to see that the peaceable traffic of the world across the Isthmus of Panama shall not longer be disturbed by a constant succession of unnecessary and wasteful wars.

The same message was sent to the American minister at Bogota on November 6. Within a few weeks all the so-called "great powers" of the earth, following the lead of the United States, formally recognized the independence of the Republic of Panama, and by the 1st of March following practically all the governments of the world except Colombia had recognized it.

The news of the revolution had scarcely reached Colombia before its government began to confess judgment on its conduct toward the Hay-Herran treaty. On November 6 the American minister at Bogota sent a cable message to Secretary Hay containing an offer from General Reyes to reassemble the Colombian Congress and ratify the treaty as signed, or to approve it by government decree, provided the United States Government would uphold Colombia in declaring martial law and suppressing the revolution on the isthmus. In commenting upon this proposal, President Roosevelt, in his special message to Congress on January 4,



Christening the flag of the Republic of Panama, Panama City, November 6, 1903.

Standing in front at the right, in gorgeous uniform, is General Esteban Huertas who, as commander of the Colombian garrison at Panama, made the revolution a bloodless success by joining forces with its leaders.

1904, containing a statement of his action in recognizing the Republic of Panama, said:

I pass by the question as to what assurance we have that they [the Colombians] would now keep their pledge and not again refuse to ratify the treaty, if they had the power; for, of course, I will not for one moment discuss the possibility of the United States committing an act of such baseness as to abandon the new Republic of Panama.

Both President Roosevelt and Secretary Hay made formal and unequivocal denial of the charge that was made in the press of collusion between the United States Government and the Panama revolutionists. The President, in the message quoted above, said:

I hesitate to refer to the injurious insinuations which have been made of complicity of this government in the revolutionary movement in Panama. They are as destitute of foundation as of propriety. The only excuse for my mentioning them is the fear lest unthinking persons might mistake for acquiescence the silence of mere self-respect. I think proper to say, therefore, that no one connected with this Government had any part in preparing, inciting, or encouraging the late revolution on the Isthmus of Panama and that save from the reports of our military and naval officers, no one connected with this Government had any previous knowledge of the revolution except such as was accessible to any person of ordinary intelligence who read the newspapers and kept up a current acquaintance with public affairs.

Secretary Hay, in a letter to General Reyes, under date of January 5, 1904, said:

Any charge that this government or any responsible member of it held intercourse, whether official or unofficial, with agents of revolution in Colombia is utterly without justification. Equally so is the insinuation that any action of this government prior to the revolution in Panama was the result of complicity with the plans of the revolutionists. The department sees fit to make these denials, and makes them finally.

In a private letter to James F. Rhodes, the historian, written under date of December 8, 1903, Secretary Hay said: *

It is hard for me to understand how anyone can criticize our action in Panama on the grounds upon which it is ordinarily attacked. The matter came on us with amazing celerity. We had to decide on the instant whether we would take possession of the ends of the railroad and keep the traffic clear, or whether we would stand back and let those gentlemen cut each other's throats for an indefinite time, and destroy whatever remnant of our property and interests we had there. I had no hesitation as to the proper course to take, and have had no doubt of the propriety of it since.

In the light of all the facts in the case which have been disclosed since the revolution, a brief outline of which has been given in this and preceding chapters, these denials seem unnecessary. The government at Washington would have been blind and deaf had it not perceived what was planning on the isthmus, and a government that was aware of what was going on there and yet did not take all necessary precautions to

* By kind permission of Mr. Rhodes.

preserve order, prevent bloodshed, and fulfil its treaty obligations would have been unfaithful to its duty. What Colombia was doing in regard to the treaty was disclosed by the course of its representatives and the demands of its authorized agents—it was “holding up” the United States for more money. This was admitted by the final proposal of General Reyes which was fitly characterized by President Roosevelt as too base for discussion.

One of the first acts of the provisional government of the Republic of Panama was to appoint, on November 6, 1903, Philippe Bunau-Varilla envoy extraordinary and minister plenipotentiary to the United States, with full powers to conduct diplomatic and financial negotiations. Bunau-Varilla was in Washington at the time, and on November 13 he was received formally by President Roosevelt at the White House. On the following day the Secretary of State sent a cable message to all the diplomatic representatives of the United States in foreign countries as follows:

The President yesterday fully recognized the Republic of Panama and formally received its Minister Plenipotentiary. You will promptly communicate this to the government to which you are accredited.

The negotiation of a treaty between the United States and the Republic of Panama was begun at once by Secretary Hay and Bunau-Varilla, and was completed and signed by them at Washington on November 18, 1903. It was ratified by Panama on December 2, was sent to the Senate on December 7, and

ratified by that body on February 23, 1904. It was approved by the President on February 25 and proclaimed on February 26.* Under its provisions the United States guarantees and will maintain the independence of the Republic of Panama. In return for the payment of \$10,000,000 made on the date of the exchange of ratifications, and for an annual payment of \$250,000 beginning nine years after that date, the Republic of Panama grants in perpetuity to the United States a strip of territory ten miles wide and extending three marine miles into the sea at either terminal, for use, occupation, and control, together with all lands lying outside this zone which are necessary for the construction of the canal or for its auxiliaries, and the islands of Perico, Naos, Culebra, and Flamenco in the Bay of Panama. The cities of Colon and Panama are not embraced in the zone, but the United States assumes their sanitation and, in case of need, the maintenance of public order therein. Within the zone the United States has all the rights, power, and authority which it would possess and exercise were it the sovereign of the territory, to the entire exclusion of the exercise of sovereign rights by the Republic of Panama. All railway and property rights possessed by Panama pass to the United States. The right is granted to the United States to use its police and military forces and to build fortifications at its discretion and at all times for the protection of the canal. In many of its details

* See First Annual Report of the Isthmian Canal Commission, 1904, for full text of the treaty, of the Spooner Act, and other documents bearing on the subject.



Founders of the Panama Republic.

Left to right, seated: J. A. Arango, Manuel Amador Guerrero, Federico Boyd.
Standing: N. A. de Obarrio, Manuel Espinosa B., C. C. Arosemena, Tomas Arias, Ricardo Arias.

the treaty follows the stipulations of the Hay-Herran treaty, but it differs from that in granting to the United States absolute sovereignty in the Canal Zone, a power that has been of incalculable advantage in constructing the canal.

Delegates to a national constitutional convention were elected in the Republic of Panama on December 28, 1903, and the convention assembled in the city of Panama on January 15, 1904. It was composed of thirty-two deputies and the members of the provisional government. A constitution was completed and signed on February 13 and proclaimed and put in force on February 15. After finishing its task the convention resolved itself into a national assembly and elected Doctor Manuel Amador Guerrero President of the republic and Pablo Arosemena, José Domingo de Obaldia, and Carlos Mendoza first, second, and third Designates or Vice-Presidents. Doctor Amador Guerrero was inaugurated President on February 20.

PART IV
PERIOD OF CONSTRUCTION
1904-1915

PART IV
PERIOD OF CONSTRUCTION
1904-1915

CHAPTER I

BEGINNINGS OF AMERICAN RULE AND WORK

THE most formidable obstacle that confronted the United States Government as it entered upon the task of canal construction was the evil reputation of the isthmus as a place of disease and death. The heavy mortality among the laborers during the construction of the Panama Railroad and later during the operations of the French canal company had given the isthmus a world-wide fame as the permanent abode of yellow fever, the worst forms of malaria, and all tropical diseases—a veritable pest-hole of the earth, into which no dweller of the temperate zone could enter without peril to his health and life. In order to construct the canal, it was necessary to collect a working force, and it was impossible to collect and maintain an efficient force unless the isthmus was first made a place in which men could live with reasonable assurance of safety.

President Roosevelt realized at the outset that thorough sanitation must precede and accompany actual

construction. Following closely upon the ratification of the treaty with Panama he had selected, on February 29, 1904, an Isthmian Canal Commission* in accordance with the specifications of the Spooner Act which authorized him to nominate, subject to approval by the Senate, a body of seven men, "at least four of whom shall be persons learned and skilled in the science of engineering, and of the four at least one shall be an officer of the United States Army, and at least one other shall be an officer of the United States Navy, the said officers respectively being either upon the active or retired list of the Army or of the Navy." The members of the commission were to serve until the completion of the canal unless sooner removed by the President, were to receive such compensation as he should prescribe until otherwise fixed by Congress, and should "in all matters be subject to the direction and control of the President."

The commission was confirmed by the Senate on March 3, and its members organized immediately, with Rear-Admiral John G. Walker as chairman, fixing its headquarters in Washington. On March 8, the commission called in a body upon the President, and in a formal address of instructions to them, he said: "There is one matter to which I wish to ask your special attention—the question of sanitation and hygiene. You will take measures to secure the best medical experts for this purpose whom you can get." Again, on May 9, in a letter to the Secretary of War, placing him in charge of canal matters, he wrote:

* Appendix A.



First Commission for Canal Construction.

Left to right, seated: Maj.-Gen. George W. Davis, Rear-Adm. John G. Walker, Frank J. Hecker, William Barclay Parsons.
Standing: William H. Burr, Benjamin M. Harrod, Carl E. Grunsky.

It is a matter of first importance that the most approved and effective methods and measures known to sanitary science be adopted in order that the health conditions on the Isthmus may be improved. It is the belief of those who have noted the successful results secured by our army in Cuba in the obliteration of yellow-fever in that island that it is entirely feasible to banish the diseases that have heretofore caused most mortality on the isthmus, or at least to improve as greatly the health conditions there as in Cuba and Porto Rico. I desire that every possible effort be made to protect our officers and workmen from the dangers of tropical and other diseases, which in the past have been so prevalent and destructive in Panama.

Before the work of sanitation could be begun a form of government must be devised and established in the Canal Zone. The treaty between the United States and Panama had provided for the payment of forty million dollars to the French canal company for all its rights, privileges, property, etc., on the isthmus, and ten million dollars to the Republic of Panama for Canal Zone and other territory. An Act of Congress, approved on April 28, 1904, appropriated the fifty million dollars necessary for these two purchases, and authorized the President, on the acquisition of the canal properties, to take possession of and occupy on behalf of the United States the Canal Zone; and until the expiration of the Fifty-eighth Congress, unless provision for the temporary government of the Canal Zone were sooner made by Congress, all the military, civil, and judicial powers, as well as the power to make all rules and regulations necessary for the government of

the Canal Zone, and all the rights, powers, and authority granted by the terms of the treaty with Panama were vested in such person or persons, and were to be exercised in such manner as the President should direct.

Under the authority thus conferred, President Roosevelt, on May 9, issued an executive order, placing the work of the Isthmian Canal Commission, both in the construction of the canal and in the exercise of governmental powers in the Canal Zone, under the supervision and direction of the Secretary of War, who at the time was William H. Taft. In the same executive order the commission was given power to legislate, and Major-General George W. Davis, U. S. A., member of the commission, was appointed governor of the Canal Zone. Governor Davis entered upon his duties on May 17, and also assumed, temporarily, charge of canal properties and engineering work.

The purchase of canal properties was completed on April 23 by the payment of forty million dollars to the French company, and on May 4, at 7.30 A. M., at the French administration building in the city of Panama, formal transfer of them was made to Lieutenant Mark Brooke, U. S. A., who had been authorized by the United States Government to receive them in its name. On May 7, the French company transferred 68,887 of the 70,000 shares of the Panama Railroad Company to the authorized agent of the United States Government.

The commission sailed from New York on March 29 for its first visit to the isthmus, arriving on April 5, and remaining till April 20. In compliance with the

President's suggestion, the commission was accompanied by Colonel William C. Gorgas, Medical Corps, U. S. A.; Doctor John W. Ross, Medical Director, U. S. N.; Captain C. E. Gillette, Corps of Engineers, U. S. A., and Major Louis La Garde, Medical Corps, U. S. A., as experts on sanitation, detailed by their respective departments of the government to examine health conditions on the isthmus and report a plan of sanitation. They returned to Washington, after a thorough investigation, and reported a plan for the sanitation of the Canal Zone and the cities of Panama and Colon. This plan was adopted by the commission, and on June 2, 1904, Colonel W. C. Gorgas was appointed chief sanitary officer under it, and was authorized to proceed with its execution.

In the meantime General Davis had taken the first steps toward the establishment of a civil government in the Canal Zone. His first official act had been the issuing, on May 19, 1904, of a proclamation announcing to the people of the Canal Zone that he had assumed government of their territory by order of the President of the United States. On June 16 an agreement was signed by him and by the officials of the Panama Government, which contained a provisional delimitation of the zone as described in the canal treaty.

Colonel Gorgas arrived on June 28, and on June 30, General Davis, as governor of the Canal Zone, issued an order announcing the organization of the Sanitary Department, with Colonel Gorgas at its head. On September 2 there was created a Department of Public Health, with jurisdiction over the cities of Panama and

Colon as well as the Canal Zone. It was composed of the chief sanitary officer, chairman; the director of hospitals, Doctor John W. Ross; the chief quarantine officer, Doctor H. R. Carter, of the United States Health and Marine Hospital Service; and the chief sanitary inspector of the Canal Zone, Joseph Le Prince. It was under the authority of, and reported to, the governor of the Canal Zone.

During 1904 Governor Davis, acting in connection with the commission as a legislative body, and under the advice of Charles E. Magoon, its general counsel, and in accordance with executive orders of the President, established a zone government, with a governor, executive secretary, treasurer, and auditor; a judicial department consisting of a supreme court, three circuit courts, and five municipal courts; departments of public health, revenues, police, and prisons; a postal service; and a bureau of education with a school system; and enacted a penal code, a code of criminal procedure, and laws suppressing lotteries and prohibiting gambling.

CHAPTER II

THE TAFT *MODUS VIVENDI* WITH THE REPUBLIC OF PANAMA

MOST of the legislation and other governmental acts of the commission and Governor Davis, outlined in the preceding chapter, proved to be satisfactory in practice. There were several matters, however, concerning which there was much dissatisfaction among the Panamanians. One of these was the tariff regulations, and another was the postal service. An executive order was issued on June 24, putting into force on the isthmus the Dingley tariff act, the effect of which was to make the Canal Zone for tariff purposes a part of the United States, and to exclude it from the Republic of Panama by a tariff wall. There was such vigorous protest to this order that Governor Davis postponed the execution till November 19, and for reasons which will be mentioned later it was never enforced.

A postal service had been established by executive order on June 24, with nine post-offices and with Panama Railroad station-agents as postmasters. Panama postage-stamps (which were Colombian stamps surcharged "Panama") having the words "Canal Zone" overprinted with a rubber stamp were used, and the

rate was two cents. As the Panama postage rate for United States mail was five cents—the rate of the Universal Postal Union—the establishment of a two-cent rate in the Canal Zone completely destroyed the postal revenue of the Panamanian Government from United States mail. All persons wishing to send a letter from the Panama Republic to the United States had only to step across the zone line, buy zone stamps, and send it for two cents instead of five.

Furthermore, when the Republic of Panama was established, its only currency was depreciated Colombian silver. In the days of the French canal companies the fluctuations in the price of this currency had led to much gambling in exchange, great confusion, and heavy loss to the working force. A Panama currency of some kind was imperatively demanded.

To settle these and some other minor matters in dispute Secretary Taft, at the request of President Roosevelt, went to the isthmus in November, 1904, arriving there on the 27th and remaining till December 7. He was accompanied by the chairman of the Isthmian Canal Commission, Admiral Walker; its general counsel, Charles E. Magoon; and José Domingo de Obaldia, who was then envoy extraordinary and minister plenipotentiary of the Republic of Panama at Washington.

President Taft entered at once upon a series of negotiations with the Panamanian Government, which resulted in an executive order, or *modus vivendi*,* which was issued by the Secretary in the President's name on December 3. By the terms of this order there

* First Annual Report of Isthmian Canal Commission, 1904.

was to be free trade between the Canal Zone and the Republic of Panama, and all importations of merchandise to the isthmus, except those which the treaty of Panama stipulated should be admitted free of duty for the United States Government or its employes, must be entered through Panama ports and pay Panama duties, providing existing duties of fifteen per cent *ad valorem* were reduced to ten per cent. The United States retained terminal ports at Ancon and Cristobal for clearing and entering by foreign vessels.

In regard to postage, Panama conceded the two-cent rate in return for an agreement that the United States Government should purchase its stamps from the Panama Government for forty per cent of their face value, surcharging them with the words "Canal Zone," the remaining sixty per cent to be retained by the zone government to defray its own postal expenses. This proved to be a valuable concession to Panama, for down to the close of 1912 there had been paid to that republic, as its share of zone postal revenues, about \$280,000, an average of \$35,000 a year for eight years.

In order to get rid of the depreciated and fluctuating Colombian currency, an agreement which had been made on June 24, 1904, at a monetary conference held in Washington between representatives of the United States and Panama, was put into execution. It provided that the Panamanian Government should coin three millions of silver pesos for issue on the isthmus. The intrinsic value of the peso was forty cents, and it was declared to be equal to fifty cents gold and main-

tained at that value by the Panama Government with the assistance of the United States authorities. The Panama Government deposited fifteen per cent in value of the three-million issue in a New York bank to maintain the fifty-cent parity.

Under this agreement three million pesos were coined at the mint in Philadelphia and were put into circulation on February 12, 1905. On April 1 an additional million was put in circulation to meet a monetary stringency on the isthmus. From the time that this agreement went into effect till April 29, 1906, the funds necessary to pay commission expenses on the isthmus were furnished by local banks under an agreement fixing three-fourths of one per cent premium as compensation for the service. After that date the funds were obtained by shipment of United States money direct from the Sub-Treasury in New York, thus saving a considerable sum annually in bankers' commissions.

In the original *modus vivendi* it was not stipulated that there should be any discrimination between native and other laborers in regard to the free importation, provided in Article XII of the treaty with Panama, of "all provisions, medicines, clothing, supplies, and other things necessary and convenient for the officers, employes, workmen, and laborers in the service and employ of the United States and their families." The Panama merchants made such strong appeals to Secretary Taft to have native laborers excluded from the privileges of buying supplies at the United States commissaries that he issued a supplementary executive

order on January 7, 1905, exempting "all employes and workmen who are natives of tropical countries" from commissary privileges, but declaring that should it develop thereafter that Panama merchants charged prices in excess of legitimate profit, or practised other extortion, the commission should at once extend commissary benefits and privileges to native or tropical employes.

It developed in July, 1905, that either through scant supplies or a desire to force up prices the Panama merchants were unable to meet the demands of tropical laborers at reasonable prices, and at once the commission opened its commissaries to them. There were repeated and emphatic protests subsequently from Panama merchants, but the United States Government refused to heed them.

Other stipulations of the *modus vivendi* were the granting to the United States of complete sanitary and quarantine control over the ports of Panama and Colon, confirming the delimitation of the Canal Zone and boundary of Ancon harbor, and directing the construction of a road, about four miles in length, at the expense of the United States Government, from the city of Panama across the "Savannas" to the eastern limit of the zone line. This was in consideration of the waiver by the Panamanian Government of its claim for compensation for the use in perpetuity of municipal buildings located in the Canal Zone.

The Isthmian Canal Commission exercised legislative powers under the Act of April 28, 1904, till the expiration of the Fifty-eighth Congress, on March 4,

1905, when, according to the terms of that act, it ceased to possess such powers. After March 4, 1905, the Canal Zone government was administered in accordance with laws already enacted and through executive orders down to the completion of the work.

CHAPTER III

INEFFICIENCY OF A SEVEN-HEADED EXECUTIVE BODY — FAILURES AND REMOVAL OF THE FIRST COMMISSION

ACTIVE operations had scarcely begun on the isthmus when it became apparent that a commission of seven members, each one an executive, and all called upon to exercise executive functions as a unit, was poorly adapted for a work of such kind and magnitude. Though composed of excellent material, the first commission was an ineffective body almost from the start. It was made up of strong individualities, several of whom, either by temperament or through age, were incapable of harmonizing with or yielding to others. The result was constant friction, with no common policy of action and no general comprehension of the magnitude of the work. There was no question of the honesty and professional ability of its members, but they showed themselves incapable of working together for a common purpose. As a body they were at odds with one another, with their chief engineer, and with the governor of the Canal Zone. Requisitions for needed supplies were either not granted at all or only granted after long delay, and then only in part. There were confusion, procrastination, lack of system everywhere.

Immediately after its return from its first visit to the isthmus the commission had appointed John F. Wallace, a civil engineer of Chicago with large experience in railway construction, chief engineer of canal work, at a salary of twenty-five thousand dollars and a residence on the Isthmus, his appointment taking effect on June 1. Mr. Wallace arrived on the isthmus on June 29, and entered upon his duties on July 1. He was from the outset the worst sufferer from the inefficiency of the commission. He complained bitterly of the incompetency of the men sent to him through the commission, and of its delay and failure in granting his requisitions. Similar complaint was made by the chief sanitary officer in regard to requisitions, and in both cases subsequent examination showed ample provocation. Requisitions were either disregarded entirely or granted after long delay and in such reduced measure as to make them of little value.

Success under such conditions was an impossibility, but they were only a part of the obstacles with which Mr. Wallace had to contend. An ignorant and unreasoning clamor to make the "dirt fly" had arisen in the United States immediately after the purchase of canal properties from the French. Mr. Wallace started for the isthmus with this cry ringing in his ears. He endeavored to comply with it by beginning the work of excavation at once. There were at the time about seven hundred men employed by the French at work in Culebra with out-of-date machinery that was in very poor condition. There was an immense amount of railway and other equipment, mostly out of date

and useless, scattered along the line of the canal. The machine-shops were in bad repair, and their equipment was also out of date. There were two thousand one hundred and fifty buildings that had been left by the French, most of which were worth repairing, but few of which were suitable for quarters in their existing condition. There was no system of food supply. The native supply was inadequate, unsuitable, and prices were exorbitant. The Panama Railroad was fully a quarter of a century behind the times in personnel, roadway, and rolling-stock.

In short, conditions on the isthmus were such that a period of at least two years should have been allowed exclusively for preparatory work, with no attempt at actual construction. In that time the question of type of canal could have been settled finally, a working force could have been assembled and provided with quarters and a food supply, and the work of sanitation could have been completed. This would have been the policy adopted but for the absurd clamor to make the "dirt fly." Mr. Wallace and the commission felt compelled to yield to it. He, with their approval, attempted to go ahead with excavation with inferior working machinery, without an adequate railway system, and without suitable quarters or food for his men. He was able to assemble during the year in which he held his position an inefficient working force of about eight thousand five hundred men, and to excavate a total of about seven hundred and forty-two thousand cubic yards. During that period also about three hundred and fifty of the French buildings were

repaired, the various machine-shops were overhauled and enlarged, the construction of water and sewer systems for Panama and Colon was begun, surveys and soundings were made, and as much of a working plant as the commission would consent to order was ordered, including steam-shovels and cars for the railroad. Wharves at the terminals of the railway on the Atlantic and Pacific were repaired and enlarged, and the first steps toward organizing a system for receiving and handling supplies were taken.

The commission had not been in office six months before its ineffectiveness became so apparent that one of its members, Mr. Hecker, resigned on November 16, 1904, and another, Mr. Parsons, advised the President of his intention to do so, on the ground that it was not so organized as to make executive work by it successful. In a letter to the President, on January 12, 1905, transmitting the first annual report of the commission, Secretary Taft said that the commission had shown itself to be an unelastic body and not well adapted to canal work. About the same time General Davis wrote to the Secretary, alluding to newspaper rumors of a reduction in the size of the commission and saying that he hoped they were true because he was "satisfied that the present body is far and away too cumbersome and ineffective."

President Roosevelt had reached a like conclusion, and in transmitting the Secretary's letter and the commission's report to Congress he accompanied it, on January 12, 1905, with a message requesting such amendment of the Spooner Act as would enable him

to select a smaller commission, preferably one of three persons. The House passed a bill in accordance with his desires, but it failed in the Senate. The President thereupon decided to exercise the power already vested in him, and proceeded to reorganize the commission in the interest of centralized authority and greater efficiency. After the adjournment of Congress on March 4, 1905, he asked the members of the commission for their resignations, and on April 1 he appointed an entirely new commission, with the single exception of Major Benjamin M. Harrod, who was retained.*

The plain truth about the first commission was stated with characteristic clearness and force by Secretary Taft in his testimony before the Senate Committee on Interoceanic Canals on April 1, 1906:

The chief defect of the old Commission, if I may say so, became apparent when it essayed the tremendous executive task of perfecting an organization to furnish the equipment, the material, and the supplies required in increasing quantity on the Isthmus as the work expanded, with promptness and dispatch. This was a complaint which Mr. Wallace might most justly make and which he did make. It was one of the chief obstacles in the performance of his task.

I do not mean to say that under any circumstances and under any management the opening of the canal project and the ordering of equipment, supplies and construction material at such a long distance would not have been attended with exasperating delays, but it is quite apparent that the methods of the Commission for this purpose were not businesslike, expeditious, or systematic.

*Appendix A.

CHAPTER IV

REORGANIZATION OF THE COMMISSION ON EFFECTIVE LINES — JOHN F. STEVENS AS CHIEF ENGINEER — INTERNATIONAL CONSULTING BOARD — LOCK CANAL DECREE

CONGRESS having declined to grant President Roosevelt's request for a smaller, more efficient, and less expensive commission, he decided to use the large powers which he possessed under the Spooner Act to convert the required seven-headed body, so far as possible, into an efficient executive and administrative force. In an executive order addressed to the members of the new commission, April 1, 1905, he directed that the chairman, chief engineer, and governor of the Canal Zone should be constituted an executive committee, and that the executive work should be divided into three departments, the head of the first to be the chairman, who should have charge of making contracts and purchasing supplies and be in executive control of the entire business of the commission; the head of the second to be the governor of the Canal Zone, who should have charge of the administration and enforcement of law on the isthmus and all matters of sanitation; the head of the third to be the chief engineer, who should have full charge of the work of construction on the isthmus. The chairman was to reside in the

United States, visiting the isthmus from time to time. The governor of the Canal Zone and the chief engineer were to reside on the isthmus. Quarterly meetings of the full commission were to be held in January, April, July, and October on the isthmus, and all action by the executive committee was to be submitted to the commission for approval. The four last-named members of the commission were constituted an engineering committee to act in an advisory capacity.

The new arrangement was put in operation at once, but had scarcely got under headway when Mr. Wallace resigned, on June 28. He was succeeded as chief engineer by John F. Stevens, who was appointed on July 1, sailed for the isthmus on July 20, and took charge on July 26. His salary was fixed at thirty thousand dollars. Mr. Wallace's resignation had been a great surprise to the government, and he was rebuked publicly and with much vigor by Secretary Taft for his conduct in the premises. All the papers in the case are on record in the files of the War Department and in reports of investigations by senate and congressional committees. They have no place in the present narrative.

The second commission, after the arrival of Mr. Stevens as chief engineer, took hold of the task upon the isthmus with great energy. Mr. Stevens had qualifications for the work which were second, perhaps, to those of no other engineer in the United States. The problem before him for solution was, first of all, one of transportation. To construct the canal an enormous amount of earth and rock must not only be excavated

but moved over distances ranging from three to thirty miles. For this purpose a railway system on the most approved lines and with the best modern equipment must be constructed. In work of this kind Mr. Stevens had had large experience in the far Western section of the United States and was an acknowledged expert of the first rank. Mr. Shonts, who was to work with him on the isthmus, was a practical railway man but not an engineer, and while he was nominally Mr. Stevens's superior officer he was actually his intelligent coadjutor and prompt agent in executing the comprehensive and masterly plans which the fertile and trained mind of Mr. Stevens evolved.

Mr. Stevens had been on the isthmus but a very short time when he reached the conclusion that it was unwise to attempt excavation on a large scale under existing conditions. Acting on his suggestion, the new commission, during its first visit in July, 1905, directed that excavation should practically cease until the necessary preliminary work should be accomplished, and that in the meantime canal work should be confined to putting the various levels in Culebra Cut into proper condition for the installation and operation of the maximum number of steam-shovels when these should arrive and the laying of additional railway tracks.

From that moment till the end of the year 1906 the commission devoted all its energies to the necessary preliminary work. During that year and a half it spent in this field \$30,000,000, of which about \$5,000,000 was for government and sanitation; about \$7,000,000 for construction of quarters and other build-



John F. Wallace,
First Chief Engineer.



John F. Stevens,
Second Chief Engineer.

ings, docks, wharves, railway enlargement, water-works, and sewers for the Canal Zone, and engineering work; about \$12,000,000 for permanent plant; about \$4,500,000 in miscellaneous material and supplies; and more than \$1,500,000 in sewers, water-works, and paving in the cities of Panama and Colon.

At the end of that time the isthmus had been converted into as healthful a place of abode as could be found anywhere in the tropics and more so than many places outside the tropics; yellow fever had been banished for all time; the harmful activities of malarial mosquitoes had been greatly restricted; adequate quarters, comfortably furnished, had been provided for all employes; a system for the abundant supply of pure food at moderate prices, brought from the United States, had been established and was working well; an ample supply of pure water had been secured for all cities, towns, villages, and camps; the Panama Railroad had been double-tracked for the greater part of its length and furnished with new and heavier rails and a modern personnel and equipment; terminal railway yards and two great intermediate forwarding and receiving yards for dirt-trains had been constructed; new wharves at the terminals on the Atlantic and Pacific, with modern unloading machinery, had been built and the harbors about them dredged; a thorough system for receiving, handling, and distributing the vast amount of supplies which came on every steamer had been created and put in operation; great machine-shops, with modern appliances, had been enlarged from the old ones, and in these all the locomotives, cars,

steam-shovels, and other portions of the canal plant, which arrived from the States in parts, were set up or put together.

This would have been a remarkably rapid achievement under favorable conditions; accomplished as it was, two thousand miles from the base of supplies, it constituted a notable tribute to American enterprise and energy. The work was not only done quickly, but with intelligence and sagacity. The plans which Mr. Stevens evolved, and which the commission under Mr. Shonts's leadership executed, proved, when put to the test in subsequent action and construction, to be admirably adapted to the purposes for which they had been designed. Mr. Stevens had laid the foundation securely and well. The men who took up the task after he had laid it down were one and all unstinted in praise of the ability and far-seeing intelligence which had characterized his labors. President Roosevelt recognized the value of his services by appointing him a member of the commission in July, 1906, making him thereby a member of the executive committee with Mr. Shonts and Governor Magoon.

During the first half of 1906 there was a gradual increase in the amount of excavation, but until the final decision as to the type of canal to be constructed should be reached Mr. Stevens directed operations in such a manner that the excavation accomplished would be useful for any type of canal. He was also steadily assembling a working force. That which the French had left, amounting to about seven hundred men, was very inefficient, and was gradually replaced by a new



From a photograph, copyright, by Underwood & Underwood.

Second Commission for Canal Construction.

Left to right: Brig.-Gen. Peter C. Hains, Rear-Adm. Mordecai T. Endicott, Theodore P. Shonts, Benjamin M. Harrod, Charles E. Magoon, Joseph Bucklin Bishop, secretary; Col. Oswald H. Ernst.

one which at the end of 1905 comprised about seventeen thousand men. Early in 1906 the commission began systematic efforts to recruit laborers from Europe, chiefly from northern Spain, and by the end of the year about nine hundred had arrived and were at work on the isthmus. By the middle of 1906 the work had advanced nearly as far as it could be carried with wisdom until the decision as to type was reached.

To aid in arriving at this decision President Roosevelt, under date of June 24, 1905, invited the most eminent civil engineers of the United States and Europe to constitute an International Board of Consulting Engineers, to consider the various plans proposed for an isthmian canal and report their verdict to him. This board, as finally constituted, was composed of eight Americans and five Europeans, as follows:

George W. Davis, Major-General, U. S. A. (retired),
and member first Isthmian Canal Commission,
Chairman.

Alfred Noble, Chief Engineer, Pennsylvania Railroad Company.

William Barclay Parsons, Chief Engineer, Rapid Transit Commission, New York City, and member first Isthmian Canal Commission.

William H. Burr, Professor of Civil Engineering in Columbia University, New York City, and member first Isthmian Canal Commission.

Henry L. Abbot, Brigadier-General, U. S. A. (retired).

Frederic P. Stearns, Chief Engineer of Metropolitan Water and Sewerage Board of Massachusetts.

Joseph Ripley, Chief Engineer of the Sault Sainte Marie Canal.

Isham Randolph, Chief Engineer, Chicago Drainage Canal.

William Henry Hunter, Chief Engineer, Manchester Ship Canal; nominated by the British Government.

Adolph Guérard, Inspector of Bridges and Highways, France; nominated by the French Government.

Eugen Tincauzer, Chief Engineer, Kiel Canal; nominated by the German Government.

J. W. Welcker, Chief Engineer of Waterstaat; nominated by Netherlands Government.

Edouard Quellenec, Consulting Engineer, Suez Canal; nominated by Netherlands Government.

The board assembled in Washington on September 1, 1905, and continued its deliberations till January 10, 1906. Its members visited the isthmus in October, making a thorough investigation of the line of the canal, and visited also water-works of interest in the United States. A final vote was reached on November 18, 1905, when a resolution in favor of a sea-level canal was adopted by a vote of eight to five, as follows:

Ays: Hunter, Welcker, Quellenec, Guérard, Tincauzer, Burr, Parsons, Davis.

Noes: Ripley, Randolph, Stearns, Abbot, Noble.

It was noted at once in the press that the majority was composed of five foreigners and three Americans; that only two of the three Americans were engineers, and that five of the eight American members of the



The International Board of Consulting Engineers.

Left to right, standing: John C. Oakes, secretary; Brig.-Gen. Henry L. Abbot, Eugen Tincuazer, Edouard Quellenec, Isham Randolph, Seated: Joseph Ripley, William Henry Hunter, Adolph Guérard, J. W. Welcker, Alfred Noble, Maj.-Gen. Geo. W. Davis, William Barclay Parsons.

board, all engineers, were against the sea-level project. The lock canal was hailed in some quarters as the "American canal" as distinguished from the sea-level or European canal. While the members of the board were preparing majority and minority reports an active campaign was begun in the newspapers and in Congress by the advocates of the two types of canal. On January 10, 1906, the board presented two reports to the President, one signed by eight members in favor of a sea-level canal, and the other signed by five members in favor of a lock canal at eighty-five feet above sea-level. Both reports were referred by the President, through the Secretary of War, to the Isthmian Canal Commission for consideration and action. The commission returned them to the Secretary of War on February 5, 1906, accompanying them with a report of its own approving the lock-canal project favored in the minority report of the International Board. Chief Engineer Stevens concurred in this approval. One member of the commission, Admiral Endicott, dissented and put himself on record in favor of the sea-level plan. On February 19, 1906, the Secretary of War transmitted the several reports to the President in a letter in which he concurred with the Isthmian Canal Commission in recommending the lock-canal project, and on the same date the President sent the Secretary's letter and the several reports to Congress, accompanying them with a brief message in which he also concurred with the recommendations of the commission.

The reports were before Congress continuously from that time till near the date of adjournment, at the end

of June. An animated contest was waged in the Senate during that period, with much uncertainty as to the outcome. There was no doubt at any time concerning the attitude of the House, as a large majority of that body was known to be in favor of a lock canal. Finally, on June 21, the vote was taken in the Senate and the lock-canal project was approved by thirty-six ayes to thirty-one noes. The House concurred without a division on June 27, and the act became law through the President's approval on June 29.

When the decision was finally recorded as law, the commission was in readiness to go ahead with the work of construction under the most favorable conditions. Work began with much energy on July 1, and in spite of a record-breaking rainfall in November and December over a million and a half cubic yards were excavated in Culebra Cut during the final six months, bringing the total excavation at all points during the year to 4,948,497. This was more than double the total excavation for 1904 and 1905, which had been only about 2,000,000.

CHAPTER V

VISIT OF PRESIDENT ROOSEVELT — CANAL MEDALS — SPECIAL MESSAGE TO CONGRESS — REBUKE TO CA- LUMNIATORS

IN November President Roosevelt, accompanied by his wife, paid a visit of three days to the isthmus, arriving on the U. S. S. *Louisiana* on the afternoon of the 14th, and remaining till the evening of the 17th. This visit was notable as being the first instance in which an American President had passed out of United States territory while holding the office. A special station was erected on the Panama Railroad near the Canal Zone boundary at Panama in order that he might land on United States territory, and this was used by him and his party during his visit. A wing of the Hotel Tivoli, which was then nearing completion, was fitted up for his accommodation and that of the members of the canal commission and the American minister to Panama, who, with members of their families, had joined the presidential party. This was the first use of the Tivoli as a hotel. The rooms occupied by the President and his wife were called the "Presidential Suite," and have retained the name since. At the end of his visit the hotel was closed till January 1, 1907, when it was opened formally to the public.

The President, accompanied by the commission, the chief engineer, and other canal officials, made a thorough inspection of all portions of the work, giving up every daylight hour to the task for two and a half days and putting to a severe strain the physical strength of more than one of his companions. On the afternoon of his first day ashore he passed over the boundary line into the city of Panama where he was met by the President of the republic, Doctor Amador, who had called upon him, with Mrs. Amador and members of his cabinet, on board the *Louisiana* in Colon harbor on the previous evening. He was greeted in the city with great throngs of people, and was escorted to the cathedral steps by a specially organized squad of "Panamanian Rough Riders," clothed in Rough Rider uniform and mounted upon prancing horses.

On the platform in front of the cathedral a formal reception was held, President Amador welcoming him in a brief address, and President Roosevelt responding. In the evening he attended a state dinner given by President Amador, which was followed by a reception.

On the evening of his departure, a mass reception to President Roosevelt was held in the great building which covered the largest wharf of the Isthmian Canal Commission at Cristobal. Virtually the entire canal force was present, crowding the immense structure, which was decorated with flags and lanterns. The President delivered an address which aroused great enthusiasm. He told the canal workers that they were engaged in one of the great works of the world, a greater work than they themselves at the moment realized,



From a photograph, copyright, by Underwood & Underwood.

President Roosevelt addressing President Amador on the steps of the Cathedral, Panama, November 15, 1906.

and that those of them who did well in bringing the enterprise to completion would "stand exactly as the soldiers of a few, and only a few of the most famous armies of all the nations stand in history. I do not pity you," he added, "because you have before you a hard task. I would feel ashamed of you if I thought you wanted pity. I admire you. I wish that any one of my boys was old enough to take part in the work. I feel that to each of you has come an opportunity such as is vouchsafed to but few in each generation. I shall see if it is not possible to provide for some little memorial, some mark, some badge, which will always distinguish the man who for a certain space of time has done his work well on this isthmus, just as the button of the Grand Army distinguishes the man who did his work well in the civil war."

On his return the President requested Francis D. Millet, the accomplished artist and charming gentleman who lost his life in the *Titanic* disaster in April, 1912, to make suggestions in regard to the proposed memorial, and he recommended a medal of the size of a silver dollar. The Isthmian Canal Commission was asked for suggestions as to design and inscriptions, and it recommended that on one side there should be a medallion portrait of President Roosevelt and on the other the seal of the Canal Zone. The first part of the recommendation was adopted by Mr. Millet, but the second was rejected, and instead of the seal there was adopted a bird's-eye view of Culebra Cut, in the completed canal, with a ship passing through, and the motto of the seal, "The Land Divided, the World

United," inscribed above it. The work was placed in charge of Victor D. Brenner, an eminent sculptor, who modelled a medallion of President Roosevelt at personal sittings at Oyster Bay in July, 1908.

Over one hundred pounds of copper, bronze, and other material from French locomotives and machinery on the isthmus was shipped to the United States mint in Philadelphia, and from these the medals were cast. They were awarded to all Americans in the canal and Panama Railway employ who had served two years or more on canal work. Each additional two years of service was indicated by the attachment of a bar so inscribed. Distribution of the medals, inscribed with the name of the recipient and the date of his original employment, was begun in September, 1909, and in 1913 about six thousand had been delivered. They are very highly prized by their owners, and the bestowal of them has contributed materially to the patriotic pride in their work which is so universal in the canal force, and which has been the chief cause of its remarkable efficiency.

President Roosevelt gave a detailed account of his visit, with his impressions and conclusions thereon, in a special message to Congress under date of December 17, 1906. This document is unique in American history as being the only illustrated message ever sent to the national legislature. It was received with some consternation by the Senate, being regarded as that truly awful thing, "an innovation," but the august members recovered sufficiently from their alarm a few days later to order the printing of ten thousand copies

for distribution by themselves among their constituents. The members of the House, without even a quiver of alarm, greeted it with delight as the best campaign document possible, and ordered many thousands of copies printed for their personal use.

The message had a wide circulation throughout the United States and in Europe, and was of incalculable value in placing before the world the truth about conditions on the isthmus. The position and character of its author commanded for it universal attention and unquestioning acquiescence.

Almost from the very beginning of American work on the isthmus there had been in certain portions of the American press a well-nigh continuous fusillade of bitter and obviously malicious criticism, the object of which seemed to be to defeat the project, and the effect of which was to aggravate seriously the difficulty of inducing desirable persons to go to the isthmus. During the year immediately preceding the President's visit this hostile attack had been especially venomous and apparently systematic. There seemed to be behind it powerful influences which were determined to prevent the construction of the canal. In his special message the President spoke of two kinds of criticism, honest and malicious, and of the latter he said:

Where the slanderers are of foreign origin, I have no concern with them. Where they are Americans, I feel for them the heartiest contempt and indignation; because, in a spirit of wanton dishonesty and malice, they are trying to interfere with, and hamper the execution of, the greatest work of the kind ever attempted,

and are seeking to bring to naught the efforts of their countrymen to put to the credit of America one of the giant feats of the ages. The outrageous accusations of these slanderers constitute a gross libel upon a body of public servants who, for trained intelligence, expert ability, high character and devotion to duty, have never been excelled anywhere. There is not a man among them directing the work on the Isthmus who has obtained his position on any other basis than merit alone, and not one who has used his position in any way for his own personal or pecuniary advantage.

The message did what no other utterance could have done. It turned back the flood of slander on the slanderers themselves and drove them and all imitators out of the business. The names of this unsavory squad of professional maligners of their countrymen, this association of moral assassins who, at the safe distance of two thousand miles, assailed the character and integrity of those who were serving their country at the post of danger, have passed into oblivion. The most reckless and unrestrained of them staggered into obscurity under the crushing load of popular contempt which President Roosevelt and Secretary Taft, by their exposure of his mendacity, placed upon him. There was begun later a second and no less virulent assault upon the work, but this was directed against the engineering features of the canal plan and not against the personnel of the workers. It will be treated in a subsequent chapter.

CHAPTER VI

THE THIRD COMMISSION — UNITED STATES ARMY ENGINEERS IN CHARGE — QUALIFICATIONS OF COLONEL GOETHALS — THE CANAL RECORD

THE period of active construction had scarcely begun with the year 1907 before another change in the composition of the commission was foreshadowed. Early in the year Mr. Shonts, whose relations with Mr. Stevens had ceased to be harmonious, resigned to accept the presidency of the Interborough-Metropolitan Railway Company of New York City, his resignation taking effect on March 4. Before that date was reached Mr. Stevens asked the President to relieve him as soon as possible from his duties, and the request was granted with the stipulation that he should remain until his successor could become familiar with the work. On March 4 Mr. Stevens was appointed chairman, as well as chief engineer, and he held the two positions till April 1, when his resignation went into effect. His withdrawal from the enterprise fairly compelled the President to make a radical reorganization of the commission. As he said at the time, he had no alternative. It was useless to try to construct the canal with a new chief engineer every twelve months, since a permanent, stable force would be unattainable under such con-

ditions, and without a permanent force satisfactory results could not be achieved. He had made two efforts to have the canal constructed by civilians, and in both instances the civilian who was chief engineer had thrown up the job as soon as he had tired of it. "I propose now," he said, "to put it in charge of men who will stay on the job till I get tired of having them there, or till I say they may abandon it. I shall turn it over to the army." He thereupon requested the chairman of the commission, on February 26, 1907, "In order to secure continuity of engineering control and management in the future," to assign to the office of chief engineer Lieutenant-Colonel George W. Goethals, a member of the Corps of Army Engineers.

This was done on the following day. The commission at the time consisted of only five members. Charles E. Magoon had, in October, 1906, been transferred to Cuba as Provisional Governor, and Colonel Ernst had a short time before been transferred to the Mississippi River Commission. These vacancies had not been filled. The resignations of Mr. Shonts, effective March 4, of Messrs. Hains, Harrod, and Endicott, effective March 16, and of Mr. Stevens, effective April 1, were accepted, and early in March President Roosevelt appointed an entirely new commission,* with Lieutenant-Colonel Goethals as chairman and chief engineer. This body assumed its duties April 1, 1907. The salary of the chairman and chief engineer was fixed by the President at fifteen thousand dollars, and of the other members at fourteen thousand dollars.

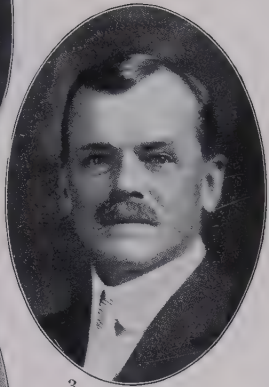
* Appendix A.



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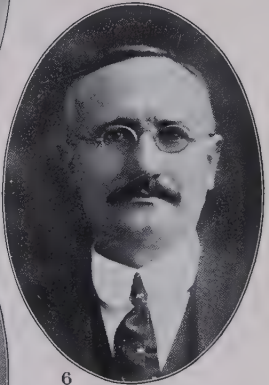
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Builders of the Canal.

1, Lt.-Col. H. F. Hodges, U. S. A. 2, Col. W. C. Gorgas. 3, Lt.-Col. D. D. Gaillard, U. S. A. 4, Sidney B. Williamson. 5, Civil Engineer H. H. Rousseau, U. S. N. 6, Col. William L. Sibert, U. S. A. 7, Col. George Washington Goethals, U. S. A., chairman and chief engineer, at the time of his appointment, March, 1907; from a photograph, copyright, by Clinedinst.

Hitherto the headquarters of the commission had been in Washington, where all the members except the governor and chief engineer had resided. The reorganization had been effected with two principal ends in view: first, that each member of the commission should have active connection with some branch of the work; and, second, that the entire body should live on the isthmus. In accordance with this purpose, the Washington office was reduced to a purchasing department mainly, and the headquarters of the commission was removed to the Canal Zone. Also in accordance with this purpose, Colonel Gorgas was made a commissioner because of his connection with sanitary work, and in like manner Jackson Smith because of his services in collecting a working force and providing quarters and a food supply. The army officers and the naval officer, under Colonel Goethals, each became the head of a department or division of the work, while the second civilian member of the commission, ex-Senator Blackburn, became the head of the civil government of the Canal Zone, also under direction of the chairman.

Colonel Goethals entered upon his new duties at a critical moment in the canal work, for two civilian chief engineers, one after the other, each after serving less than a year, had abandoned the task, their departure leaving the force in a condition of great nervous uncertainty about the future. It was a civilian force, and the change from civil to military control was a hazardous proceeding, for it might so aggravate existing uneasiness as to create thorough demoralization. There had been much talk of "militarism" preceding

his arrival, but he soon made it apparent that efficiency was the final test with him, and that no civilian subordinate with that qualification need worry about his tenure. Soon after his arrival, at a reception which was given to him, he said:

I will say that I expect to be the chief of the division of engineers, while the heads of the various departments are going to be the colonels, the foremen are going to be the captains, and the men who do the labor are going to be the privates. There will be no more militarism in the future than there has been in the past. I am no longer a commander in the United States Army. I now consider I am commanding the Army of Panama, and that the enemy we are going to combat is the Culebra Cut and the locks and dams at both ends of the canal. Every man who does his duty will never have any cause to complain on account of militarism."

He carried out this assurance to the letter. The result was that there were few changes in the force, and those were in the interest of greater efficiency. In fact, the change in control had been effected at the psychological moment in canal construction. Mr. Stevens, who was perhaps the first expert of his time in the field of railway construction, had completed that part of the task. He had designed and executed a plan of transportation which experience was to prove to be admirably adapted for its purpose. He had applied to this task the knowledge acquired in thirty years of active railway engineering work, to which his life had been devoted, and the value of the service he

thus rendered can scarcely be overestimated. No one has placed a higher or more generous estimate upon it than Colonel Goethals. In speaking of it in 1913, he said: "People talk about the success of the army engineers at Panama, but it was fortunate that Mr. Stevens preceded us. The real problem of digging the canal was the disposal of the spoil, and no army engineer in America could have laid out the transportation scheme as Mr. Stevens did. We are building on the foundations he laid, and the world cannot give him too much credit."

For the next step in canal work, dam and lock construction on a scale of magnitude unattempted hitherto, expert knowledge and practical experience of equally high order were demanded, and were found in the engineering corps of the army. Colonel Goethals, as well as several of his associates, brought to the task trained ability of the first order, supplemented by several years of practical experience in the same field. Few men more thoroughly equipped for the work could have been found in the United States. Colonel Goethals had been graduated at the head of his class at West Point in 1880, had been for four years instructor in civil and military engineering in that institution, and for six years and a half had been in charge of lock and dam construction under government direction in various parts of the United States. At the time of his appointment as chairman and chief engineer of the Isthmian Canal Commission he had won for himself the undisputed reputation of ablest member of the corps of engineers of the United States army. When

it became apparent to President Roosevelt that the work of canal construction must be put in charge of the army, there was no debate as to the choice of a head. Lieutenant-Colonel Goethals was by unanimous consent the man for the place, and such indeed he has proved himself to be.

The organization created by Mr. Stevens was continued for a time, but Colonel Goethals gradually introduced changes in the direction of simplicity and concentration of authority, and built up an organization which, while not conforming strictly to army methods, was constructed along similar lines.

In 1908 the quartermaster system of the army was adopted, when the civilian member of the commission who had been in charge of what was called the department of labor, quarters, and subsistence, Mr. Jackson Smith, resigned, and was succeeded by Lieutenant-Colonel H. F. Hodges, of the engineering corps of the army. The department as it had existed under Mr. Smith's direction was abolished, and two new departments were created in its stead: quartermaster's, with Colonel C. A. Devol at its head as chief quartermaster; and commissary and subsistence, with Colonel Eugene T. Wilson at its head—both army officers, and both responsible directly to the chairman and chief engineer.

The superior merits of the system put in operation by Colonel Goethals were soon apparent. There was less friction, increased unity of action, and a greater willingness to render prompt obedience to orders.

While adopting and following certain army methods



The Third Commission for Canal Construction.

In front, centre: Col. George W. Goethals, U. S. A., chairman and chief engineer. Others, from left to right: Maj. Wm. L. Sibert, U. S. A.; J. C. S. Blackburn, Civil Engineer H. H. Rousseau, U. S. N.; Joseph Bucklin Bishop, secretary; Lt.-Col. H. F. Hodges, U. S. A.; Col. W. C. Gorgas, U. S. A.; Lt.-Col. D. D. Gaillard, U. S. A.

of administration, Colonel Goethals avoided studiously all appearance of militarism. During the entire period of construction no one ever saw him in uniform, for he had none on the isthmus. He adhered faithfully to his pledge to make efficiency the supreme test of employment, and while most of the places of responsibility were held by army officers detailed by the War Department, he retained in others of the first importance civilians who were in them when he took charge. He found among these civilians some of his most trusted and loyal, as well as most efficient assistants, and he was hearty and unstinted in expressing his appreciation of the high value of their services. By accomplishing the gigantic task intrusted to him Colonel Goethals won a great and lasting triumph for the engineering corps of the United States army, and he won it all the more speedily and surely because for the time being he placed his profession of engineer above that of soldier and brought into his service the best talent attainable, wherever it was to be found.

A signal instance of this was his prompt recognition and extremely valuable use of the rare and varied abilities of the naval member of the commission, H. H. Rousseau, civil engineer. At the time of his appointment to the commission Mr. Rousseau was chief of the Bureau of Yards and Docks in the Navy Department, with the rank of rear-admiral, having been selected for that position in January, 1907, by President Roosevelt, who considered him the ablest of the civil engineers of the navy. Colonel Goethals authorizes this estimate of his services in connection with canal work:

His technical training and previous experience, combined with his executive and administrative ability, fit him admirably for his position. He has had charge and supervision of shops, municipal work, building construction, terminals, and the design and construction of dry docks and coaling stations. His counsel in questions of organization, cost-keeping, and the preparation of estimates, has been invaluable, and, in his way, he has been as indispensable to me as Colonel Hodges.* Twice has the Navy Department desired his return to duty at Washington, and on one occasion the Secretary of the Navy especially requested the President for his relief from duty on the Isthmus in order that the Navy Department might avail itself of his services.

One of the early acts of Colonel Goethals was the establishment of a weekly publication, called the *Canal Record*, under the supervision of the secretary of the commission. Colonel Goethals had perceived that there was no means by which intelligence about canal work was carried from one division to another, and that the resulting ignorance about the progress of the work as a whole was a distinct obstacle to that general interest which was necessary for the development of *esprit de corps*. The *Canal Record*, which was really a weekly report of what was going on in every division, aroused general interest and stimulated a healthy rivalry, which was of incalculable benefit in various ways. It increased the efficiency of the force, welded it into a single body, and made it more contented. By giving space also to the social life and

* See p. 180.

activities of the Canal Zone this beneficial influence was augmented. The paper was distributed free to all employes on the isthmus, and was also sent to members of both houses of Congress, to libraries, scientific societies, newspapers, civil engineers, and such other persons in the United States and in foreign countries as seemed entitled to receive it. Its beneficial effect outside the isthmus was no less than that which it exerted among the canal force. Through its official publication of the truth about canal work it closed the mouths of professional slanderers and sensational writers in the United States by supplying a constant and unassailable refutation of their misstatements. Its permanent value is unique, for it is the official and authentic weekly history of canal work during the entire period of construction. It has been sought and obtained by nearly or quite all the engineering and scientific schools and societies of the world, and its bound volumes of yearly issues have been placed in the libraries of these societies and of the educational institutions of the United States and other countries.

CHAPTER VII

CULEBRA CUT — ONE-FOURTH OF ITS ENTIRE EXCAVATION DUE TO SLIDES AND BREAKS

EVERYTHING was in readiness for vigorous and effective work when the new commission took charge in April, 1907. The preparatory stage of the work had come to an end, and the period of active construction had begun. A large part of the plant ordered by Mr. Wallace and Mr. Stevens, including about sixty powerful steam-shovels, was at hand; the tracks of the transportation system planned by Mr. Stevens were in place, and modern spoil cars, trackshifters, unloaders, and spreaders were already in use. A working force steadily growing in numbers and efficiency had been assembled.

The chief point of attack was, of course, the Culebra Cut, then, as always, the most formidable obstacle to be fought and overcome. How much more formidable it really was than had been suspected was soon to be revealed.

No part of the canal more completely confounded the preliminary estimates of some of the highest engineering authorities in the United States and Europe than the slides and breaks in the banks of the canal prism through Culebra Cut. The International Board of

Consulting Engineers, in 1906, after a thorough study of the question by a special committee, placed the probable total amount at 500,000 cubic yards. The minority report of the same board placed the total amount of Culebra Cut excavation for an 85-foot level canal at 53,800,000 cubic yards, and the majority report estimated the amount necessary at the same point for a sea-level canal with a depth of 40 feet at 110,000,000 cubic yards. In 1908 the canal commission, in a revised estimate, placed the total Cut excavation at about 78,000,000 cubic yards. In 1910 it increased it to 84,000,000; in 1911 to 89,000,000; in 1912 to nearly 94,000,000; and in 1913 to about 100,000,000. The increase was due partially to widening the bottom width of the channel in the Cut from 200 to 300 feet, authorized by President Roosevelt in 1908, an increase of about 13,000,000 cubic yards, and other enlargements of the original plan, but mainly to breaks and slides.

A careful study of the geological structure of the Cut had been made in 1898 by two eminent French engineers, Philippe Zürcher and Marcel Bertrans, the latter a professor of geology in the National High School of Mines at Paris, and in their report they declared, in referring to slides:

The question of these cavings-in was formerly a cause of great anxiety, but that cause no longer exists. That of Cucaracha was partly due to want of care in the method of constructing the embankments, and it was easily stopped by comparatively simple works of drainage. . . . There are no caving belts to fear, ex-

cept the clays of the upper part which are already almost entirely excavated, and if any special precautions are to be taken against cavings-in, it would only be for the small extent of about 1 kilometer (0.62 mile) where the slope of the clay is toward the Cut.

Professor William H. Burr, who was a member of the International Board of Consulting Engineers, and was a strenuous advocate of the sea-level as opposed to the lock-level type of canal, said in his testimony before the Senate Committee on Inter-oceanic Canals, in March, 1906, in regard to slides in the Cut:

All that is necessary to remedy such a condition is simply to excavate the clay or to drain it to keep the water out. It is not a new problem. It is no formidable feature of the work. It is simply to be treated down on the Isthmus as it would be treated here. There would be no slipping of the clay in the vicinity of the Culebra Cut if it is drained, as it may be, or if portions of it, where it may readily be treated in that way, are excavated. It is not a material difficulty; it is not an obstacle to the construction of a sea-level canal. It simply means drainage and excavation; that is all. I might say that I speak, perhaps, with undue emphasis on this point, because I have been over every foot of that ground myself, and in view of my previous experience with slipping clay, I speak not from hearsay or opinion but actual observation over many years.

These opinions were based mainly upon what is known as the Cucaracha slide, on the east bank of the canal, just south of Gold Hill, which is the highest point of the Culebra Cut. This first began to move

in 1887, during the most active period of French operations, and I am assured by persons who were on the isthmus at the time that it caused a feeling among the French engineers that very nearly approached consternation, they seeing in it a most formidable obstacle to the sea-level canal which they were engaged in constructing. Be that as it may, the French engineers at once ceased operations in that vicinity and never resumed them. In consequence the slide was quiescent during the remaining period of French work. Scarcely had the Americans begun excavation there in 1905 when the slide began to move again in the first wet season, and to resume movement in the succeeding wet season. On October 4, 1907, after a period of very heavy rains, it started afresh in the night. Without warning, it shot almost completely across the canal prism, overwhelming two steam-shovels in its course, covering all the dirt-train railway tracks, and for ten days maintained a glacier-like movement of fourteen feet each twenty-four hours. During that time it filled the canal prism and piled up a mass of material thirty feet in height on the west bank. Nearly half a million cubic yards of material were thrown into the canal prism by this movement, and the operation of dirt trains through this part of the Cut was delayed for about a month. In January, 1913, during the dry season, it again became active, carrying about 2,500,000 cubic yards more into the Cut, blocking all tracks in the bottom of the canal, and bringing the total slide excavation at this point up to about 7,000,000 cubic yards.

The Cucaracha slide was the largest of those classed as normal or gravity slides. These occurred where there was a top layer of porous material resting upon a sloping surface of rock or other harder material. The water of heavy rains, sinking through the overlying porous material, caused a muddy, slippery zone to form between that and the harder material below, sending the entire top layer, of a thickness varying from ten to forty feet, into the canal prism. Slides of another type, involving a very much greater amount of excavation, are classed by geologists as structural break or deformation slides. These were due to unstable geological rock formations, steepness and height of slopes, and effects of blasting. As excavation advanced, and lateral support was removed from the high banks in the deepest portions of Culebra Cut, the underlying layer of rock of poor quality and soft material, unable to sustain the enormous weight above it, was crushed and forced laterally into the prism of the canal, causing a heaving of the bottom to a height varying from 15 to 30 feet, and a shearing and settling of the slopes. The most formidable slides of this character occurred during the dry season, and were in no way due to saturation by rainfall. They were completely unforeseen by any of the engineers who had studied conditions in the Culebra Cut before active operations were begun by Americans. The two most serious occurred on opposite sides of the canal, one north of Gold Hill, and the other in front of the village of Culebra. That on the west bank covered an area of 75 acres, involved the removal of about 10,000,000



Culebra Cut. Cucaracha slide. Steam-shovel working on the bottom of the canal, January 4, 1913.

cubic yards of material, and invaded the site of the village to such an extent that a large number of its buildings had to be removed or demolished. That on the east bank covered an area of 50 acres and involved the removal of about 7,000,000 cubic yards of material. Together these two slides widened the top width of the canal at this point from 840 to about 2,000 feet.

There were at various times during canal construction 22 slides of different kinds, covering an area aggregating 220 acres, and compelling an excavation of about 25,000,000 cubic yards, or about one-fourth of the excavation required for the Culebra Cut. In addition to the extra work required for removal of this material, the interruption of work and general annoyance caused by the slides must be taken into account. Colonel Gaillard, the division engineer in charge of the work in Culebra Cut, estimated the amount of railway track that was destroyed by them within 8.8 miles of the Cut at fully 200 miles, and that they delayed the completion of the excavation in the Cut by at least a year and a half. This delay did not affect the date of canal completion, however, because that depended upon the concrete and gate work in the locks. In spite of the addition of the 25,000,000 cubic yards of slide excavation, the Culebra Cut was ready for use when the condition of the lock work allowed the water to be turned in.

In regard to the method used in the treatment of slides, Colonel Gaillard's views, published in November, 1912,* are those of an expert and of the first value:

* *Scientific American*, Nov. 9, 1912.

Innumerable plans for treating the slides have been suggested by interested and patriotic citizens throughout the country, but not one of them has proven practicable. The only successful method of treating the slides or breaks, once the material is in motion, is to dig it out and haul it away until the slide comes to rest upon reaching the angle of repose for the particular material then in motion. This angle of repose varies much in different localities, depending upon the character of the material composing the slide, the angle of inclination of the strata and the angles of the numerous dikes, faults, seams, etc. At the Cucaracha slide the angle of repose corresponds to a slope a little steeper than one vertical to five horizontal, while on the west bank of the Cut at the town of Culebra, the material is still moving slightly on a slope of about one vertical to five horizontal.

In one or two slides which have developed in the Cut, the surface on which the material was sliding had a slope of one vertical to ten horizontal, and in the case of another slide on the west bank of the canal, north of the village of Culebra, the moving material, which consisted of stratified rock, was moving *en masse*, at the rate of three feet in twenty-four hours, on a lignite layer about six inches thick, which had a slope of about one vertical to seven horizontal and was underlaid by layers of sedimentary rock, which did not move. A rather remarkable thing about this last slide was that, like two or three other slides, it developed in the dry season and moved at a faster rate during the four months when there was no rain than it has done since the rains have come.

The writer is aware that there is a very general impression that slides are due solely to saturation by rainfall, or underground water, of the material which is in motion, and while this is to a great extent correct

for the slides like the one at Cucaracha, yet there have been three large slides, involving in all nearly two million cubic yards of material, which developed during the dry season and were composed wholly of material so dry that when loaded on the trains, the cars were almost hidden during the windy season by clouds of dust. One of these slides was moving on a surface which had a slope of one vertical to six horizontal, and its rate of advance was about two and one-half feet per day for several months. A steam shovel made one hundred and three cuts across the toe of this slide with the position of the loading track unchanged.

But while the slides were an annoyance and added heavily to the task in hand, they were of great value in demonstrating the utter impossibility of constructing a sea-level canal across the isthmus, thus vindicating the wisdom of the minority members of the International Consulting Board and the foresight of President Roosevelt, Secretary Taft, and the first canal commission in favoring and securing the adoption of the lock plan. A sea-level canal would cost billions of money, in all probability would never be completed, and if completed, could not be kept open for navigation. This is virtually the universal opinion among engineers to-day.

The work in Culebra Cut was under the direction of W. E. Dauchy as division engineer from November, 1904, till July, 1906. He was appointed by Mr. Wallace, and retained by Mr. Stevens until the latter date. He was succeeded by D. W. Bolich, who retained the position of division engineer after the Goethals administration came in, on April 1, 1907, acting under Colonel

D. D. Gaillard as head of the Department of Excavation and Dredging. He retained the position till May, 1908, when he resigned and was succeeded by L. K. Rourke. On July 1, 1908, a new organization was created, consisting of three divisions—Atlantic, Central, and Pacific, and Colonel Gaillard was made division engineer of the Central Division which included Culebra Cut. L. K. Rourke was made assistant division engineer, retaining that position till June 1, 1910, when he resigned to accept the position of superintendent of streets in Boston, Mass. He was the author of the organization for work in the Culebra Cut which was continued in operation with remarkable success till the completion of the task. On his retirement the position of assistant division engineer was abolished, and Colonel Gaillard assumed personally its duties.

CHAPTER VIII

THE WONDERFUL CULEBRA CUT

THE special wonder of the canal, its spectacular show-piece, was and still is the Culebra Cut. Those who see it first from the decks of passing ships, however, can form only a very inadequate conception of its appearance during the final years of construction, when the fight of man against Nature was at its height, Nature striking back in a quick succession of terrific blows. Then, indeed, it was one of the world's wonders, and by no means the least. Nothing else in the work was comparable to it, for this alone was destructive, while the other great features were constructive, the mere piling up of great masses of earth and concrete in accordance with well-established rules and without serious obstruction or opposition. Experience and trained ability were necessary for the proper accomplishment of these tasks, and their unprecedented magnitude made them interesting, but there was little in them to arouse enthusiasm or that could be called inspiring.

With the struggle in the Cut, it was quite another matter. Here the problems were new and strange. As John Hay once said of one of the most turbulent of the South American countries, the isthmus was a "land of the fantastic and the unexpected." No one

could say when the sun went down at night what the condition of the Cut would be when the sun arose the next morning. The work of months and years might be blotted out by an avalanche of earth or the toppling over of a small mountain of rock.

It was a task to try men's souls, and it was one also to kindle in them a joy of combat which no repulse could chill and a buoyant faith in ultimate victory which nothing could shake.

From all quarters of the globe came engineers and others engaged in construction operations to view the struggle. They came in doubt often as to the outcome, but they went away with all doubt removed. What had given them confidence was a close view of a working organization the like of which, for efficiency, perfection of detail, precision, and smoothness of operation, unity of spirit and enthusiasm, they confessed frankly never to have seen before. For an organization of that character, they said, no obstacle was insurmountable. They were not surprised, after witnessing this wonderful human machine at work, that slide after slide went into the Cut without causing the faintest shadow of uneasiness to any one concerned, and without delaying the final completion of the task. A distinguished American engineer, who himself had directed some of the largest construction enterprises in the country, after watching the organization in operation, wrote of it to a friend: "I have never seen its superior—such perfect co-ordination and such energetic prosecution at every point, all under absolute control. It is something that everyone from the chief

down is entitled to the greatest credit for and in which everyone can justly take the greatest pride. I went to the Isthmus with my mind made up to be impressed, but the actualities exceeded my anticipations."

The spectacle exceeded all anticipations, for nowhere else on earth was there to be found a display of human activity on so large a scale and with so marvellous a setting. It was this combination which added the final touch of the extraordinary to the picture. To stand at the southern end of the Cut, between the towering, majestic hills of the Great Divide, was an experience which few who had ever had it could easily forget. On either side were the grim, forbidding, perpendicular walls of rock, and in the steadily widening and deepening chasm between—the first man-made canyon of the world—a swarming mass of men and rushing railway trains, monster-like machines, all working with ceaseless activity, all animated seemingly by human intelligence, without confusion or conflict anywhere. Throughout the eight miles of the Cut the scene varied only in the setting. The rock walls gave place here and there to the ragged sloping banks of rock and earth left by the great slides, covering many acres and reaching far back into the hills, but the ceaseless human activity prevailed everywhere. Everybody knew what he was to do and was doing it, apparently without verbal orders and without getting in the way of anybody else. It was organization reduced to a science—the endless-chain system of activity in perfect operation.

Instead of detracting from the spectacular or pictur-

esque effects of the natural setting of the work, the slides enhanced them by adding a distinct touch of awe, possibly of terror. They revealed more clearly than ever the tremendous difficulties of the task and the magnitude of the victory which was being achieved in surmounting them.

The effect of a trip through the Cut while the work was in full progress was the same on all visitors—amazement coupled with admiration. Tourists from the United States emerged invariably in a glow of patriotic enthusiasm, with an irrepressible desire to remove their hats and cheer for the American flag—to let the “eagle scream.” Those from other lands, especially if they were engineers, and there were many of these from all the leading countries of the world, were scarcely less enthusiastic, and were astonished at the magnitude of the task and unstinted in expressions of admiration for the manner in which it was being accomplished. I have seen many of these during my six years’ connection with the work, but not one who did not declare it to be the finest exhibition of engineering organization and execution that he had ever witnessed. Generally, the more the observer knew of engineering and construction work, the higher and warmer was his appreciation.

What most impressed all observers, next to the organization, not merely of the Cut, but of the entire work, was the loyalty and enthusiasm of the force. An eminent visitor from Japan was especially struck by this, being apparently much surprised at its manifestation. “What are your impressions?” he was asked at the



Culebra Cut, looking north from La Pita, showing close view of rock break in east bank, October 9, 1912.

close of a careful inspection of all parts of the work, extending over a period of several days. "Is the work as great as you anticipated?" "Oh, very much greater," he replied; "it is stupendous, magnificent, colossal! No nation but the great, rich American nation could build this canal. Japan has much to learn from you."

What he saw on every hand as he moved about was not so much the wealth, resources, and power displayed in the task, but the spirit of the nation itself as revealed in the zeal and enthusiasm of the men who were doing the work. In the creation and development of this spirit the struggle in the Cut was the most powerful factor.

CHAPTER IX

CHANGES IN CANAL PLANS — LARGER LOCKS AND WIDER CHANNEL — ESTIMATES OF TOTAL COST

DURING 1907 work was prosecuted with such vigor at all points along the line of the canal that a grand total of 15,765,290 cubic yards of excavation was accomplished. In March the million cubic-yard limit was reached for the first time and passed. There was a decrease in May and June, due partly to the rainy season and partly to temporary trouble with steam-shovel operators over the question of wages, but in August a total of 1,274,000 cubic yards was reached, an achievement which called from President Roosevelt a congratulatory message by cable to Colonel Goethals. There was a large increase in September, October, and November, and in December the 2,000,000 mark was reached and passed in a total of 2,200,000 cubic yards, making the grand total for the year 15,765,290, or an average of over 1,300,000 a month. This was more than double the amount excavated during the preceding three years, which had aggregated less than 7,000,000 cubic yards.

Changes in the plan of the canal were made in 1908 which added about \$18,500,000 to the cost of construction. On January 15 President Roosevelt approved

a resolution of the Isthmian Canal Commission increasing the width of the locks of the canal from 100 to 110 feet, in accordance with an opinion of the General Board of the navy that such an increase was desirable. This added about \$5,500,000 to the cost of construction. On October 23 the President authorized the enlargement of the bottom width of the canal, throughout four and a half miles of the deepest part of the Culebra Cut, from 200 to 300 feet, making 300 feet the minimum width at any point in the entire canal. This enlargement required about 13,000,000 cubic yards of additional excavation, and entailed an extra expense of about \$13,000,000. Under the original plan this section of the canal had a bottom width of 200 feet. This and other changes in the original plan, all in the direction of enlargement, had increased the total excavation, estimated by the authors of the project at 103,796,000 cubic yards, to 174,667,000, or by more than two-thirds. After these changes had been made the total cost of the canal, including the \$40,000,000 paid to the French canal company and the \$10,000,000 paid to the Republic of Panama, was estimated by the Isthmian Canal Commission at \$375,201,000. This estimate was announced to the House Committee on Appropriations by the chief engineer, Colonel Goethals, at Washington, on February 15, 1909, and was embodied in the annual report of the commission for that year.

So far as excavation was concerned, 1908 was the "record year" in canal construction. During that year the plant, or working equipment, reached its

maximum. There were in service 101 steam-shovels, about 300 locomotives, about 4,000 dirt or spoil cars of various kinds, 46 car unloaders or ploughs, 25 spreaders, and 10 trackshifters. The railroad trackage had been increased from 74 miles in 1904 to 160 miles, with 50 miles of main track and 35 miles of double track on the Panama Railroad line, all equipped with new and heavy rails. The efficiency of the working force, through experience, had more than doubled during the previous two years. Because of familiarity with climatic conditions, nearly as much work was accomplished during each of the eight or nine months of the rainy season as during those of the dry season. As a result, the total excavation of 1908 exceeded 37,000,000 cubic yards, and the average for each month of the year, wet or dry, was about 3,090,000 cubic yards. The highest total for a single month in 1908 was that of March, which was 3,487,287 cubic yards. This was surpassed in March, 1909, when for the first and only time during canal construction the four-million mark was reached, with a total of 4,062,632 cubic yards.

This was the record-mark in excavation. The monthly totals began to drop after that date, for the reason that in several localities the work had been completed and the field of operation had been narrowed. From that time forward excavation ceased to be the primary and became the secondary element in canal work, the construction of locks and dams passing into the first position. The excavation of 1909, consequently, while exceeding 35,000,000, fell 2,000,000 below that of 1908. The grand total for the



Old village of Gatun from dam site, November, 1906.



Canal Channel, looking south from San Pablo to Caimito. Width of channel, 800 feet; surface of water, 55 feet above sea-level. October, 1912.

two years exceeded 72,000,000 cubic yards, making the average each month for that period 3,000,000 cubic yards. In 1910 and 1911 the total exceeded 31,000,000 cubic yards, the monthly average being over 2,600,000 cubic yards, and in 1912 it exceeded 30,000,000. The grand total for the five years of greatest activity, 1908, 1909, 1910, 1911, and 1912, exceeded 165,500,000 cubic yards, an average of over 2,750,000 cubic yards a month, comprising more than 75 per cent of the excavation of the entire canal.

CHAPTER X

GATUN DAM AND LOCKS — FIRST SUGGESTION OF THE SITE — ITS NATURAL ADVANTAGES — HUMOROUS AND OTHER ASSAULTS

CREDIT for the first suggestion of Gatun as the site for a great dam belongs to Godin de Lépinay, chief engineer of bridges and roads, who was one of the French delegates to the Lesseps International Congress at Paris, in 1879. This able and far-seeing engineer was one of the foremost of the opponents in that congress of the Lesseps project for a sea-level canal across the isthmus. He was a member of the committee on technique in the congress which had charge of technical questions relating to the proposed canal, including physical conditions, cost of construction, operation, and maintenance, and facility and security of operation. He made repeated efforts to obtain from Lesseps and his sea-level advocates satisfactory estimates on these points, but could get only the vaguest guesses. Having had personal experience in directing work in the tropics—being, in fact, the only French engineer in the congress with such experience—M. de Lépinay made estimates of his own in regard to the costs of a sea-level canal, and reached the conclusion that they were so great as to be prohibitive. He prepared a

paper which he read to the congress setting forth this conclusion, and proposing a canal with locks, with a dam at Gatun. In support of this plan he advanced arguments which were virtually identical with those used successfully a quarter of a century later by the advocates of the present canal.

He contended that a lock canal could be constructed for at least 500,000,000 francs (\$100,000,000) less than a sea-level canal; could be constructed in much shorter time, and at less cost of human life; would be easier and quicker in navigation; and would make the Chagres River not a menace as a canal at sea-level would, but an ally and aid to navigation.

M. de Lépinay's paper made a strong impression on the congress, but Lesseps would not consider it or permit it to be put to a vote. Its author's views had such weight, however, with the committee on technique that when the final vote on the Lesseps project was taken only nineteen of its forty-two members voted ay, while five voted no, fourteen were absent, and four declined to vote.

The Gatun suggestion had evidently attracted attention in the United States, for in 1880 it was advanced by Ashbel Welch, an American engineer, in a paper before the American Society of Civil Engineers, and again by C. D. Ward before the same society in 1904. It was not included in the lock-canal project adopted by Lesseps and the new Panama Canal company in 1887, when he was compelled to abandon his sea-level plan, for that project included one dam at Bohio and another at Bas Obispo, on the Atlantic side, with a

double flight of two locks at each point, and duplicate single locks at Paraiso, Pedro Miguel, and Miraflores, on the Pacific side, with a summit elevation of about one hundred feet above sea-level. The Isthmian Canal Commission of 1899-1901, generally known as the Walker commission, after its chairman, Rear-Admiral John G. Walker, U. S. N., followed the suggestion of the new Panama Canal company and recommended Bohio as the site for a dam. Just how much consideration, if any, this commission gave to the Gatun site does not appear from its report, for there is no mention of it; merely a statement that "no location suitable for a dam exists on the Chagres River below Bohio." The Walker commission plan included two double locks at Bohio, a lake with a summit level of ninety feet, two double locks at Pedro Miguel and one at Miraflores.

When the first commission that was appointed to construct a canal at Panama began its work, in 1904, it was proceeding under the authority of the Spooner Act of 1902, which provided merely for the construction of a "canal of sufficient capacity and depth as shall afford convenient passage for vessels of the largest tonnage and greatest draft now in use, and such as may be reasonably anticipated." No specific type of canal was designated, but the general expectation was that the lock type would be adopted. Operations were begun with that type in view, and the engineers in charge showed that they had the Gatun site in mind by making surveys and soundings at that point as well as at Bohio. These had been under way for some weeks when the first chief engineer, Mr. Wallace, took charge



Gatun Upper Locks. The foot-bridge across the Upper Guard gates, January 14, 1913.

on July 1, 1904. He continued the work during the eleven months of his administration, but he had in the meantime reached the conclusion that a sea-level canal was preferable to one with locks and took little interest in the investigations and did not make them sufficiently thorough to be decisive. Mr. Stevens, who succeeded him in July, 1905, was impressed on his first careful study of the field by the superior advantages of the Gatun site, and had such additional borings made as convinced him of its suitability. He recommended it earnestly both to the canal commission and to the International Board of Consulting Engineers when that body visited the isthmus, in 1905. Its adoption by the minority members of that board in the plan of canal recommended by them and approved subsequently by Congress was due largely to his advocacy.

No part of the canal project was more furiously or more ignorantly assailed and none has been more ludicrously misunderstood than the Gatun Dam. The majority of visitors from the United States and elsewhere, who passed in great swarms over the isthmus during the final years of construction, expected to see a structure of masonry towering more or less straight into the air for a distance of several hundred feet. What they did see was a low-lying ridge, which did not look in the least like a dam, but more like the sloping bank of a pond or river. James Bryce, the distinguished English author, traveller, and diplomatist, who visited the isthmus in September, 1910, spoke of the canal project as the "most gigantic effort yet made by man on this planet to improve upon Nature." No

part of that project is an improvement more in harmony with Nature's work than the erection of this dam at the extreme southern point in the valley of the Chagres where the encircling hills most nearly approach each other. If Nature had intended to place a great lake among the hills of the isthmus at Panama, she would have put a barrier across the valley at this point. It converts the valley of the Chagres into a huge reservoir which impounds all the water that flows into it, not only from the Chagres River, which is the principal source of supply, but from many other smaller streams. It is not only as solid as the everlasting hills, but more scientifically constructed than they are, more pains, if one may say so without irreverence, having been taken in its making. That it will hold water has been demonstrated to the satisfaction of everybody whose opinion has value. Tropical growth is covering it with a thick mantle of green, and all signs of construction are disappearing from view.

The visitor stands on its summit and asks: "Where is the dam?" If he recalls the fierce and persistent assault which was made upon both the site and the method of construction, an assault which endured for three years and attracted the attention of the whole world, he will wonder what inspired it. It was an assault as unreasoning as it was venomous. No weapon was too contemptible or too ridiculous to be used, and no ally too unworthy to be welcomed. Engineers who had advocated the sea-level plan threw aside professional etiquette and even professional pride, and sometimes openly, but oftener anonymously, gave

the color of expert knowledge to gross and shameless misrepresentation. Foreign engineers, some of whom had been connected with the Lesseps failure, were given front rank in the onslaught, and their views commanded unlimited space in portions of the American press, in ludicrous disregard of the obvious fact that if there were in the world persons whom it behooved to keep silent, they were those who had attempted to perform the task in hand and had failed. Every man with a canal plan of his own, or with an invention he wished to have adopted for canal work; every contractor whose bid had been rejected by the canal commission—all these were sure of a hearing in this chorus of misrepresentation and defamation.

No rumor was too ridiculous to be credited. An unconscious humorist, eager for journalistic fame, sent to an American newspaper a report that a great underground lake had been discovered under the Gatun Dam—and the newspapers published it, without hint of a grin! This feat excited the ambition of a rival, who was an equally unconscious humorist, and he, when an insignificant slump in one of the toes of the as yet unbuilt Gatun Dam occurred, cabled to New York and the world that the dam had “sunk.” These two grotesque “yarns”—underground lake and sinking dam—coming one after the other upon a public that had been educated to uneasiness by the persistent assault on the Gatun site, were accepted at their face value. They spread instantly, not only throughout the United States, but over Europe, carrying everywhere with them doubt about the canal project.

So wide-spread was the uneasiness created, that President Roosevelt in January, 1909, requested Secretary Taft to go to the isthmus for a personal inspection and appointed to go with him a special commission,* composed of seven of the country's most eminent civil engineers with instructions to make a thorough investigation and "report especially upon the feasibility and safety of the Gatun Dam project." Secretary Taft, accompanied by Mrs. Taft and the seven engineers, arrived on the isthmus on January 29 and remained till February 7. This was Mr. Taft's fifth visit as Secretary of War. He made two visits subsequently as President, in 1910 and 1912, being again accompanied on the latter by Mrs. Taft. As was his invariable custom in all his visits, he devoted nearly every hour of the day, in company on this occasion with the engineers of the special commission, to a thorough inspection of all parts of the work, and gave up the evenings to receptions and meetings of employes at which he made addresses. In his address in 1909 he warmly praised the manner and spirit in which the work was being carried forward and predicted certain and brilliant success. On his way back to Washington, in an informal speech at Meriden, Miss., he said:

I do not care whether you are Democrats or Republicans, you want the work done, and when the army engineers who are doing this work are giving all their time to the carrying out of this work, you are not men to go back on them or to believe every idle story that

* Frederic P. Stearns, Arthur P. Davis, Henry A. Allen, James D. Schuyler, Isham Randolph, John R. Freeman, Allen Hazen.



Special Commission of Civil Engineers, January, 1909.

Top row, left to right: Colonel Goethals, James D. Schuyler, Isham Randolph, John R. Freeman.
Bottom row, left to right: President Taft, Frederic P. Stearns, Allen Hazen, Henry A. Allen, Arthur P. Davis.

comes from the mouth of some politician who is seeking to make himself prominent, or to give himself the advertisement of a little unfounded sensational statement.

That work is being done honestly. I know what I am talking about. The Canal will be built, and all the windy opposition that comes merely from a desire to exalt and exploit the man who makes himself responsible will not obstruct it.

On February 16, the engineers made an elaborate report to the President in which they declared unanimously that a full study of the subject had left no doubt in their minds "as to the safe, tight, and durable quality of the Gatun Dam," and that they were satisfied that "the dams and locks, the lock gates, and all other engineering structures involved in the lock-canal project are feasible and safe, and that they can be depended upon to perform with certainty their respective functions."

In sending the report to Congress, on February 17, President Roosevelt said: "This report not only determines definitely the type of canal, but makes it evident that hereafter attack on the type—the lock type—is in reality merely attack upon the policy of building any canal at all."

Shortly before Secretary Taft and the engineers had gone to the isthmus, Mr. John F. Stevens, the predecessor of Colonel Goethals as chief engineer, published a letter * in which he expressed the opinion that the attack on the Gatun Dam was in the interest of the rejected Nicaraguan project, adding:

* *Engineering News*, December 31, 1908.

The question of the advisability of building an Interoceanic Canal has nothing whatever to do with the matter. The people have decided they want the canal and they are ready to pay for it. The choice of its location has been wisely made, and the work properly planned. It is in competent hands, and is being executed with a rapidity that surprises even its friends. And the thing to do is to extend to Colonel Goethals and his assistants all the encouragement and moral help possible, which the importance of the work demands. And the engineering world will have every reason to be proud of the result when it is an accomplished fact.

The publication of the report and the plain and truthful characterizations by the President, Secretary Taft, and Mr. Stevens of the real motives of the prolonged assault upon the canal work put an end to the agitation. A few feeble and spasmodic efforts were made subsequently to revive it; but these, too, ceased in August, 1909, when Congress authorized for canal construction a bond issue of \$290,569,000, in addition to previous issues, bringing the total up to the \$375,000,000 estimated as necessary for constructing the canal.

As the visitor to the isthmus to-day stands at Gatun and looks over the locks and the low-lying dam he cannot fail to wonder, if he is familiar with this long and venomous assault, what it was all about. The dam fits so completely and so unobtrusively into the natural conformation of the region that it does not seem to be at all artificial, or the work of man. It is so low and flat, so broad and solid, and so apparently a part of the

everlasting hills themselves, that it seems incredible that intelligent men should ever have raised the question of its stability and efficiency. Like the great lake whose waters it holds so surely in place, it looks for all the world as if it had been there from the dawn of time. So strong is this impression that soon after the lake was formed an ingenuous foreign visitor, who had not grasped in its entirety the plan of the canal, remarked to an engineer who was showing him about Gatun: "You were extremely fortunate, you know, to have this large body of water here!" Another visitor, with equally keen powers of observation, after having been taken over the Gatun Dam in a motor-car running on railway tracks, a proceeding consuming nearly an hour's time, and after having been told that the dam contained 21,000,000 cubic yards of material, asked his guide: "Is this a permanent or merely a temporary structure?" Still a third of this joyous class of visitors, whose advent on the isthmus contributed a welcome note of gayety to its sometimes monotonous life, after looking at the spillway of the dam, a concrete-lined channel 285 feet wide and 1,200 feet long, through which water was rushing furiously, asked thoughtfully: "Where are you going to put the roof?"

In the interest of historic truth it should be recorded that the site of the locks at Gatun was assailed as furiously and persistently as that of the dam. It was said to be composed in part of sand and gravel, to be permeable to water, and to be unsatisfactory in general. To quiet any misgivings that might be raised by these assertions, President Roosevelt, in the spring of 1907,

requested three of the highest engineering authorities on lock and dam construction in the United States—Alfred Noble, Frederic P. Stearns, and John R. Freeman—to visit the isthmus and make a personal examination of the Gatun and other sites. They went to the isthmus in April with Secretary Taft, and, by means of test pits which had been dug for the purpose, inspected the various sites, reporting on May 2 that they found that “all of the locks will rest upon rock of such a character as should furnish a safe and stable foundation.” To-day the lock walls are in place and furnish to the eye an aspect of solidity and stability equal to that of the dam. They are mere continuations upward of the natural rock upon which they stand, and are as immovable and as indestructible. There has been no sign of settling, or of leakage, or of percolation beneath or around them. Like the dam, they have confounded the direful predictions of the prophets of evil and silenced them forever.

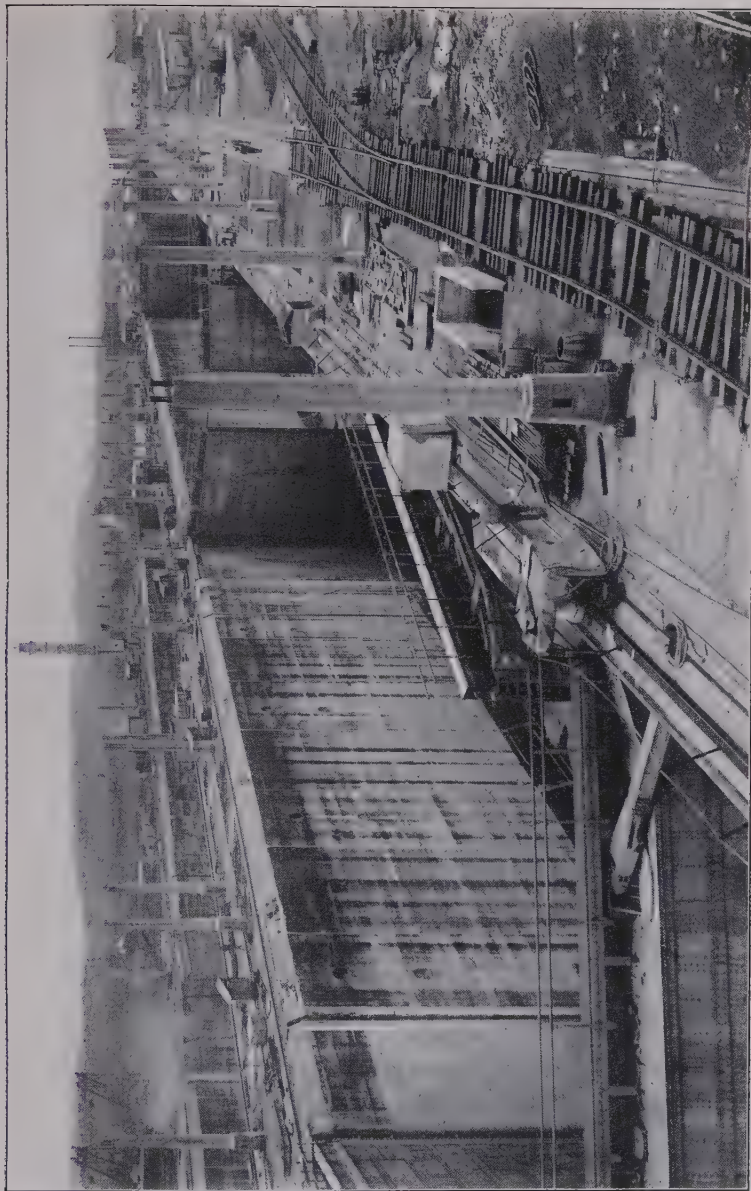
It is impossible to convey in words anything approaching an adequate conception of the picture which the series of locks, with their massive, towering walls and their equipment of colossal gates, presents. It defies description, as it does the camera, even in its wonderful modern development, and can be portrayed only by the inspired pencil of a Pennell. It is stupendous, prodigious, overwhelming; even these adjectives are inadequate. As I stood on the walls with a distinguished engineer, who had been a strenuous advocate of a sea-level canal, I asked him if he could conceive of a safer place in which to put a great ship

than inside one of the locks, and he replied without hesitation that he could not. They will be the brilliant spots in the illuminated canal, with their great clusters of electric lamps, high up on shapely concrete columns, flooding every portion of the vast structures with noon-day brightness, making them the shining centres and symbols of what Joseph Pennell calls the greatest of the world's Wonders of Work.

After the locks were completed and the huge gates, weighing from four hundred to seven hundred tons each, were being erected, the final, despairing wail of the assailants of the lock canal was emitted. Two of the gates had been finished and the test of the ability of the new machinery for opening and closing them was about to be made. A short time earlier, that indefatigable, but invariably anonymous and polyonymous personage, known indifferently as "an American engineer" or "an eminent engineer," who was very familiar in the newspapers of the United States during the early period of construction, emerged into view with the startling information that a stupendous disaster was about to occur on the isthmus. He declared that he had returned recently from a thorough inspection of the canal work and knew what he was talking about. The Gatun Dam was all right, and the slides in Culebra Cut could be disposed of easily, but a far greater peril was hanging over the project and was to be found in a totally unsuspected quarter—namely, in the huge lock gates. When the attempt was made to move these, he predicted, a truly awful catastrophe would follow, for they would move only to fall in a mass of ruins—mere

junk or "scrap." With this portentous warning ringing in his ears, Colonel H. F. Hodges, the author and supervising architect of the gates, proceeded, without visible perturbation, to Gatun one morning in May, 1912, and in the presence of other canal officials "bowdaciously," as Uncle Remus would say, turned the small switch which started the operating machinery of a gate. As the great wheel in the wall began to revolve, a leaf of the massive gate moved slowly from the wall beside which it hung, and without noise or vibration, and with perfect steadiness, swung into position at the opening of the lock. The journey was made in one minute and forty-eight seconds, twelve seconds less than was required in the specifications under which it had been constructed. Colonel Hodges pulled the switch again, and the return journey was made in the same manner and time. Since then other gates have been swung in other locks with like success and there has been no "crash," save in the reputation of the prophet who, like all his kind, concealed his identity at the moment of supreme inspiration.

The work at Gatun was under the direction of Colonel William L. Sibert during the entire period of construction. Previous to his arrival the work done had been nearly or quite all preparatory, and in this A. B. Nichols, in charge of surveys and explorations, and F. B. Maltby and William Gerig, division engineers in the Stevens organization, had been the chief agents. Mr. Maltby resigned in August, 1907. Mr. Gerig remained as division engineer of the Gatun Dam division till June 30, 1908, when he resigned. Under a new organ-



Gatun Locks, looking toward the Atlantic, June 1, 1913. Electric-light poles partially constructed. Range lighthouse at the left.

ization which went into effect on July 1, 1908, Colonel Sibert became the division engineer of the Atlantic division, which included all work at Gatun and the Atlantic entrance to the canal. Major Chester Harding, U.S.A., who had been division engineer of the Gatun Locks division, was appointed assistant division engineer. He retained that position till February 27, 1913, when he resigned to accept the position of engineer member of the board of commissioners of the District of Columbia. Others associated with Colonel Sibert in the work were Major Edgar Jadwin, Major J. C. Jervey, Captain G. M. Hoffman, Captain Horton W. Stickle, Captain W. S. Ross, and Lieutenant-Colonel William V. Judson, all of the United States army. Of these, Major Jervey and Captain Hoffman were engaged in the work during the entire period of construction, and the others for a portion of that period, with the exception of Lieutenant-Colonel Judson, who was added to the division force in place of Colonel Harding in March, 1913, after the work was nearly completed.

Full charge of all the designing work of the canal was vested by Colonel Goethals in Colonel H. F. Hodges when the latter became a member of the canal commission in July, 1908. Previous to that date, as general purchasing officer of the commission and chief of the Washington office, Colonel Hodges had been in charge of the designs for the lock gates. Colonel Goethals had desired to have him appointed to the commission when it was reorganized in 1907, but he could not be relieved from the position which he held at that time—principal assistant to the chief of engineers at

Washington. He was considered by Colonel Goethals to be the army engineer best fitted by ability and experience to supervise the designing work. He had been an assistant under General O. M. Poe, when the latter was constructing the Poe lock in the Sault Ste. Marie Canal, and had designed the steel gates for it. Colonel Goethals authorizes this estimate of his services:

He took over the designing work for the Panama Canal at a time when definite plans had to be adopted and the work carried to completion. Comprised in that work were designs for the dams, locks, gates, spillways, valves, operating machinery, hydro-electric station, and aids to navigation. He was placed in charge subsequently of the erection of gates and the installation of valves and operating machinery. Charged with the solution of the most important engineering problems of the canal, it can be said of him truthfully that the canal could not have been built without him.

CHAPTER XI

LOCKS AND DAMS ON THE PACIFIC SIDE — THE TASK MUCH SIMPLER THAN THAT AT GATUN

It is a curious fact that the most vulnerable feature of the original plan for an eighty-five-foot level canal was assailed scarcely at all by the opponents of the project. They directed their assault upon the Gatun site, paying little or no heed to the fact that at the Pacific end a site for two great dams and a double flight of two locks had been selected which had far more questionable features. Work had only begun at this site when it was demonstrated that no suitable foundations for the proposed dams could be secured save at much larger expense than had been estimated. Then, too, the locks, if erected on the site proposed, would extend out into Panama Bay and be exposed to bombardment from an enemy's ships.

Secretary Taft, on February 19, 1906, in his letter to President Roosevelt transmitting the reports of the International Consulting Board, had recommended the adoption of the lock plan except so far as it related to the dam and locks at the Pacific end. On this point he said:

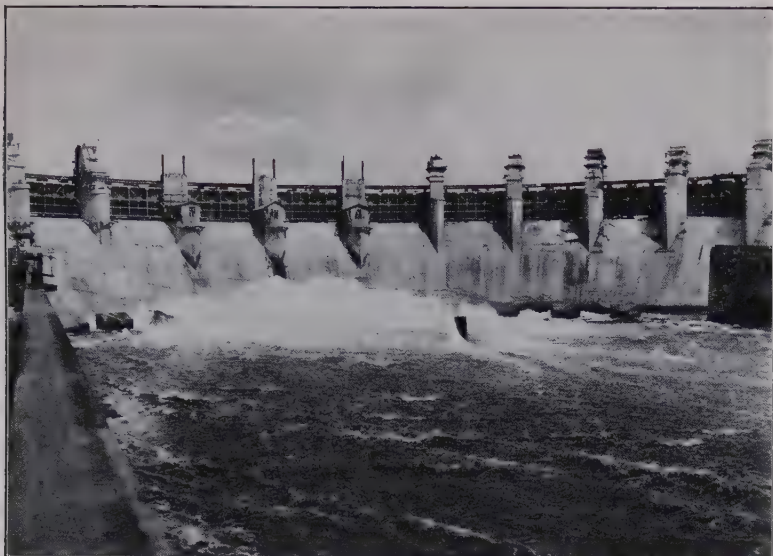
The great objection to the locks at Sosa Hill is the possibility of their destruction by the fire from an

enemy's ships. If, as has been suggested to me by officers of this Department entitled to speak with authority on military subjects, these locks may be located against and behind Sosa Hill in such a way as to use the hill as a protection against such fire, then economy would lead to the retention of this lake. The lake would be useful to commerce as a means for relieving any possible congestion in the canal should the traffic be very great and would give, in case of need, a place for concentrating or sheltering the fleet. If, however, Sosa Hill will not afford a site with such protection, then it seems to me wiser to place the locks at Miraflores.

John F. Stevens, the second chief engineer, had expressed similar views. In giving his formal approval to the plan, on January 26, 1906, he said:

As regards the plan and alignment of the canal at the Pacific end, I am still inclined to my former expressed opinion that, on account of the military and sanitary features, the location of all the locks at Miraflores and Pedro Miguel, instead of part of them at La Boca, with the necessary dam at the same place, will be found more satisfactory; but as the latter plan will cost about \$6,000,000 less to construct than the former one, I am ready to waive my views in favor of the latter plan, although simply on account of the difference in the estimated cost.

Work had been in progress only a few months on the toes of one of the dams when it was discovered, through the shifting and sinking of the trestles from which spoil from Culebra Cut was being dumped, that the material overlying the rock foundations was composed mainly of



Spillway Dam. Regulation gates in position between the piers, June 1, 1913.



Emergency dam swung across entrance of Gatun Lock, June 1, 1913.
The wicket girders will drop from the portions of the dam overhanging the water.

unctuous blue clay, without grit, possessing little supporting power, instead of a stiff clay, as indicated on the profiles of the original borings. The depth of rock below the surface varied from ten to seventy feet. A new estimate of the cost of constructing stable dams there, based upon additional borings, placed it at \$11,574,000, or more than double the original estimate of \$4,314,000. In view of all this a further examination was made of the canal route from Pedro Miguel to the Pacific to ascertain if more suitable foundations for locks and dams could be found. These resulted in showing that there existed satisfactory foundations for one lock at Pedro Miguel and for two at Miraflores, a point about a mile and a third nearer to the Pacific. The locks themselves would constitute a portion of the necessary dams, and as they would lie behind high hills and be from three to four miles inland, they would be protected against possibility of distant bombardment from the sea and be less exposed to gunboat or torpedo attack. This superior military position was of itself a very powerful reason for the change. The new project would eliminate the proposed large lake on the Pacific side, as it provided only for a small lake about a mile square between Pedro Miguel and Miraflores, and would entail a cost of about eight million dollars less than the original one.

Colonel Goethals submitted the proposed change, with the unanimous recommendation of the commission, to President Roosevelt on December 9, 1907, and the President approved it on December 20. As amended, the plan provided for a double lock, with a lift of

30 $\frac{1}{3}$ feet, at Pedro Miguel, two double locks in flight, with a combined lift of 54 $\frac{2}{3}$ feet at Miraflores, and from there to deep water in the Pacific, a distance of 8.31 miles, a channel 500 feet in width and 45 feet deep below mean sea-level.

The change of plan delayed somewhat the beginning of work on the Pacific side. There was much less clearing required than at Gatun, and this was begun early in January, 1908, and active excavation for the locks, both at Pedro Miguel and Miraflores, began soon afterward. Both sites lie in the valley of the Rio Grande, which is about half a mile wide at Pedro Miguel and about two-thirds of a mile wide at Miraflores, with hills on both sides. Between the hills and the walls of the upper locks at both places dams were erected forming a complete barrier to the water, that at Pedro Miguel maintaining the water-level of Gatun Lake, and that at Miraflores the level of the intermediate or Miraflores Lake. The natural level of the valley in which this lake lies was so near to that of the bottom of the canal prism that only about one million cubic yards of excavation was necessary for the channel through it.

The lock site at Miraflores was crossed from the west by the Cocoli River, a tributary of the Rio Grande. It is quite a formidable stream in times of heavy rains. In order to divert it from the lock site during the period of construction, and to have the use of its waters afterward in the Miraflores Lake, the dam on the west side, constructed in the same manner as that at Gatun, was run on a line nearly parallel to the axis of the locks



Pedro Miguel Locks, January 25, 1912.



Gatun Upper Locks. South entrance to east chamber. Surface of lake, 48 feet above sea-level. March 15, 1913.

from the head of them to Cocoli Hill, a distance of two thousand three hundred feet. By this means the river was made to enter the Miraflores Lake site at its upper end, flowing through it and out through a diversion channel on the east side of the locks. When the lock work was finished this channel was closed with a concrete dam, extending from the lock walls to the hills. In the dam a spillway allows the surplus water of the lake to escape and be used to supply power to the electric plant near by.

The work at Pedro Miguel and Miraflores was under the direction of Sidney B. Williamson, division engineer of the Pacific division, from its beginning till December, 1912, when he resigned to accept the offer of an important position from an English contracting firm with headquarters in London. He had been in the canal service since May, 1907; was the only civilian in charge of one of the three great divisions of canal work, and in the estimation of Colonel Goethals, who had asked him to enter the service, had no superior in the engineering force. At the time of his resignation the work at Pedro Miguel and Miraflores was nearly completed. His position was abolished, and the chief engineer, Colonel Goethals, took personal charge of the Pacific division.

CHAPTER XII

SANITATION OF THE ISTHMUS — SCIENTIFIC DISCOVERIES WHICH MADE IT POSSIBLE — MARTYRDOM OF LAZEAR

SOMETHING very like a marvel has been accomplished at Panama. A veritable valley of death has been converted into a land of health and comfort. So complete is the transformation that astonished observers have declared, with mild and not unjustifiable exaggeration, that the "foremost pest-hole of the earth has become a health-resort." If it be not in the full sense of the term a health-resort, that part of the Isthmus of Panama which is under American control is to-day as healthful a place of abode as most civilized communities anywhere, and far more so than many of them.

But while the transformation that has been wrought is marvellous, and takes rank easily as the supreme achievement in sanitation, not only of the century, but of the ages, there is nothing miraculous about it. It surpasses all previous efforts in the same field in magnitude, but not in effectiveness, simply because it was the first work on a large scale undertaken in the illuminating light of a discovery that, as by a flash of lightning, wrought a complete revolution in existing methods of tropical sanitation. Old things passed

away and all became new in those methods when in 1900 surgeons and soldiers of the army of the United States, at the risk of their lives, proved that yellow fever, the supreme terror of the tropics, was not a contagious or a filth disease, but was transmitted from one human being to another solely by a mosquito of a particular type, the *stegomyia*. It was this conviction of the *stegomyia* mosquito of high crimes and misdemeanors against the human race which lifted medical science out of the bog of blind, groping experimentation in tropical sanitation to the firm ground of exact knowledge. The sanitation of the isthmus became a mere matter of intelligent administration, and the sanitation of the isthmus made possible the construction of the Panama Canal, for without the light afforded by this discovery yellow fever could not have been banished from the isthmus, and its periodic outbreaks would have made it impossible to maintain an adequate working force of Americans. It is to the heroic men who risked their lives in the experiments which resulted in this discovery, and above all others to the martyr who both risked and lost his, that highest honors should be paid in celebrating the completion of the canal. The story of their deeds, one of the most inspiring in human annals, is entitled to first rank in the history of the canal, and especially of the sanitation of the isthmus.

When the Americans took possession of the isthmus in 1904 they began the task of converting it into a healthful place of abode and work, in the light not only of the yellow-fever transmission discovery, but of an-

other, only secondary in importance, which had been made in 1898, that malaria was transmitted in like manner from person to person by a mosquito of a different type, the *anopheles*. The details of these discoveries are so imperatively necessary to a proper comprehension of the work that has been done on the isthmus that they are set forth here in advance of the account of the work itself, considering first the yellow-fever discovery because of its superior importance.

The theory that yellow fever was transmitted from one person to another solely by means of a mosquito was advanced speculatively as early as 1847, but it was first set forth positively by Doctor Carlos J. Finlay, of Havana, in a paper published in 1881. Doctor Finlay made several experiments to test the truth of the theory, but they were not successful because he used for inoculation mosquitoes that had bitten yellow-fever patients only from two to five days earlier, whereas later experiments proved that the mosquito is harmless until twelve days or longer after the biting.

During the occupation of Cuba by the United States army in 1900 yellow fever became epidemic in Havana, and in spite of the use of all known methods for warding it off there were nearly 1,600 cases and 231 deaths among American officers and men. It was made evident to the army surgeons who were on duty there that existing methods of fighting the disease were well-nigh powerless to check its spread. They knew neither its cause nor its means of transmission. They stood by the death-beds of its victims, to quote one of them, "in utter perplexity and wonder." Doctor George

M. Sternberg, Surgeon-General of the United States Army, considering the presence of the disease as affording opportunity for testing various theories that had been advanced in regard to it, appointed four army surgeons, specially fitted for the task—Walter Reed, James Carroll, Jesse W. Lazear, and Aristides Agramonte—a board to conduct a series of experiments with a view to ascertaining the causation and method of transmission of the disease from one person to another.

The board began its experiments in June, 1900, and continued them into February, 1901. It first made thorough tests of the theory of bacterial transmission and proved it to be unfounded. It then turned its attention to the theory of mosquito transmission and decided to subject that to a series of experiments. In order to do this, human life must be put in jeopardy, for only human beings could be used for the experiments. One member of the board, Doctor Agramonte, was immune. The other three were not. These were unwilling to assume the responsibility of asking others to risk their lives unless they first risked their own, and accordingly they agreed to make the first experiments upon themselves.

To realize the complete devotion to duty and the high courage of this resolve it should be borne in mind that these men were physicians who had been close observers and students of the disease for many years and were familiar with its deadly character. They made their resolve without proclamation of any sort, without publicity or the desire of it.

The duty of breeding and infecting mosquitoes for

the tests was assigned to Doctor Lazear because of his special knowledge of mosquito work. Before the mosquitoes were ready for the tests Doctor Reed was summoned to Washington on urgent official duty and was prevented from entering the experiments. Doctor Carroll was first bitten, and suffered a very severe attack of yellow fever from which he recovered, but for a time his life hung in the balance. Subsequently Doctor Lazear, while in a yellow-fever hospital, collecting blood from the patients for study, saw a mosquito settle on the back of his hand. He allowed it to remain there, calmly studying its operations till it had satisfied its hunger. Five days later he came down with an attack of the disease "in its most terrible form," from which he died. These cases had demonstrated so conclusively that the disease was transmitted by mosquitoes that when Doctor Reed returned from Washington his friends persuaded him not to submit himself to infection, on the ground that it was a foolish and unnecessary risk for him at his age. He decided to conduct a series of more elaborate experiments for the purpose of establishing beyond dispute the truth of the new theory, and to demonstrate that not only was yellow fever transmitted by the mosquito, but by the mosquito alone.

In an address which he delivered in April, 1901, describing the results of the army board's experiments, Doctor Reed paid this affectionate tribute to Lazear:

Before proceeding to the discussion of this subject, it is fitting that I should pay brief tribute to the memory of a former member of this faculty, the late Dr.

Jesse W. Lazear, United States Army. I can hardly trust myself to speak of my late colleague, since the mention of his name brings back such scenes of anxiety and depression as one recalls only with pain. Along with these sad memories, however, come other recollections of a manly and fearless devotion to duty such as I have never seen equalled. In the discharge of the latter, Doctor Lazear seemed absolutely tireless and quite oblivious of self. Filled with an earnest enthusiasm for the advancement of his profession and for the cause of science, he let no opportunity pass unimproved. Although the evening might find him discouraged over the difficult problem at hand, with the morning's return he again took up the task full of eagerness and hope. During a service of less than one year in Cuba he won the good will and respect of his brother officers and the affection of his immediate associates. Almost at the beginning of what promised to be a life full of usefulness and good works he was suddenly stricken, and, dying, added one more name to that imperishable roll of honor to which none others belong than martyrs to the cause of humanity.

Tests had been made on nine volunteers before the infection of Doctors Carroll and Lazear, but had been without results because mosquitoes had been used too soon after biting yellow-fever patients. It was made plain by the cases of Carroll and Lazear that the infected mosquito did not become harmful till a considerable period had elapsed after biting. To establish the length of this period, and also the length of the period which must elapse after the patient has been stricken before the disease can be conveyed to the mosquito for transmission, Doctor Reed instituted a sec-

ond series of experiments in a camp established near Quemados, Cuba, and named after Lazear. General Leonard Wood, who was then military governor of Cuba, gave all possible assistance in the matter, and to encourage volunteers for the tests offered a reward of two hundred dollars for such service.

It should be remembered that this call for volunteers was issued soon after the death of Lazear, and at a time when it was common knowledge in the army that yellow fever had been given both to him and to Carroll through the bites of mosquitoes. Notwithstanding this, records Major Walter D. McCaw, of the Medical Corps of the United States army, "to the everlasting glory of the American soldier, volunteers from the army offered themselves for experiment in plenty and with the utmost fearlessness."

The first to present themselves were two young soldiers from Ohio, John R. Kissinger and John J. Moran. Doctor Reed talked the matter over with them, explaining fully the danger and suffering involved, and stating the money consideration offered by General Wood. Both young men declared that they were prepared to undergo the experiment, but only on condition that they should receive no pecuniary reward. When he heard this declaration, Doctor Reed touched his hat with profound respect, saying: "Gentlemen, I salute you!"

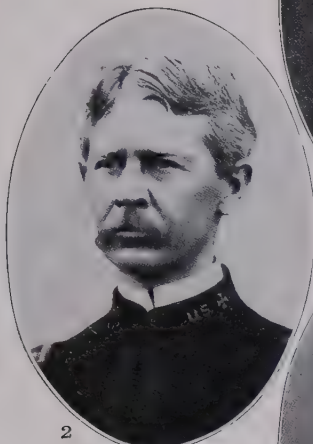
How well his respect was merited was shown a few days later when the two young soldiers faced the tests. Kissinger on three successive occasions was taken, clad only in a nightshirt, into a room where mos-



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1, Dr. Robert P. Cooke,
U. S. A.

2, Dr. Walter Reed, U. S. A.

3, Dr. Carlos J. Finlay.

4, John J. Moran.

5, Dr. James Carroll,
U. S. A.

6, John R. Kissinger.

7, Dr. Jesse W. Lazear,
U. S. A.

Heroes of the yellow-fever tests.

quitoes known to be infected were confined, and lying down, remained there quietly while they bit him. On the third day, according to Major Reed's account, "we concentrated our insects upon him, selecting five of our most promising mosquitoes for the purpose," and he was infected with the fever, from which he recovered. About the same date, a room was prepared and made hospitable by the presence of fifteen infected mosquitoes. What happened in that inviting room is thus described by Major Reed:

At noon on the same day, five minutes after the mosquitoes had been placed therein, a plucky Ohio boy, Moran by name, clad only in his nightshirt, and fresh from a bath, entered the room containing the mosquitoes, where he lay down for a period of thirty minutes. Within two minutes from Moran's entrance he was being bitten about the face and hands by the insects that had promptly settled down upon him. Seven in all bit him at this visit. At 4.30 P. M., the same day, he again entered and remained twenty minutes, during which time five others bit him. The following day at 4.30 P. M., he again entered and remained fifteen minutes, during which time three insects bit him, making the number fifteen that had fed at these three visits. On Christmas morning, at 11 A. M., this brave lad was stricken with yellow fever, and had a sharp attack, which he bore without a murmur.

Moran, like Kissinger, recovered. Well might Major Reed say of the two heroes: "In my judgment this exhibition of moral courage has never been surpassed in the annals of the army of the United States." He

might have added with perfect truth, "or anywhere else." The subsequent history of the two men will be referred to later in this narrative.

There were in all twenty-two persons who submitted to the tests, thirteen of them American soldiers, and most of them accepted pecuniary reward.

Into the tests to demonstrate that yellow fever was not a contagious disease, seven persons entered, Doctor Robert P. Cooke, acting assistant surgeon of the army, and six privates of the hospital corps. The courage shown by these men was equalled only by that of the men who had undergone the other tests. A small building with a single room, fourteen by twenty feet, was erected and carefully guarded against the entrance of mosquitoes. Its temperature was maintained at about seventy-six degrees, with a sufficient amount of humidity. It was supplied with a large quantity of bed clothing, wearing apparel, and night clothing taken from the beds and persons of patients who had died of yellow fever. For twenty consecutive nights Doctor Cooke and his men went into this room, handled, wore, and slept in the contaminated clothing, although the stench was so offensive as to be almost unbearable. They emerged from the ordeal in perfect health, proving beyond possibility of dispute that the disease was not contagious and that the mosquito was the sole method of transmission. Let any one who wishes to comprehend fully the courage required for this service ask himself if he possesses it.

Like Lazear and Carroll and the brave American soldiers who underwent the first tests, Doctor Cooke

and his associates were acting solely in the interest of humanity, were risking their lives for their fellow-men. On a tablet erected to the memory of Lazear in Johns Hopkins Hospital, at Baltimore, there is this inscription, written by President Eliot of Harvard University:

WITH MORE THAN THE COURAGE AND THE
DEVOTION OF THE SOLDIER HE RISKED AND
LOST HIS LIFE TO SHOW HOW A FEARFUL
PESTILENCE IS COMMUNICATED AND HOW
ITS RAVAGES MAY BE PREVENTED.

Surely it can be said of all the men who entered the two series of tests that they showed "more than the courage and the devotion of the soldier," for there were lacking the excitement of the battle-field, the inspiring and sustaining presence of thousands of companions, and the hope of martial glory. Unwitnessed and alone they went into the presence of death itself, remaining there for hours and days and weeks, inviting it, without thought of renown or lasting remembrance. We may well be proud that they were Americans, that we belong to a race capable of such lofty heroism. But like Lazear, who was also American, and like Carroll, who was of English birth, they belong to no country, but to the human race. Their deeds are the common heritage and the common glory of all mankind.

In order to make complete the record of experiments—in Cuba, it should be added that Doctor John Guiteras, of Havana, began in February, 1891, a series of tests for the purpose of ascertaining whether or not yellow

fever could be propagated in a controllable form by means of infected mosquitoes, thus securing immunization as is done by the use of vaccination in the case of smallpox. He infected eight persons with mosquitoes, three of whom died, including an American nurse, Miss Clara B. Maas, of Orange, N. J., who volunteered herself for the experiment. This result was so unfavorable to the theory of controllable propagation that further experiments in that field were abandoned, but the additional tests had afforded complete confirmation of the truth of the mosquito theory of transmission.

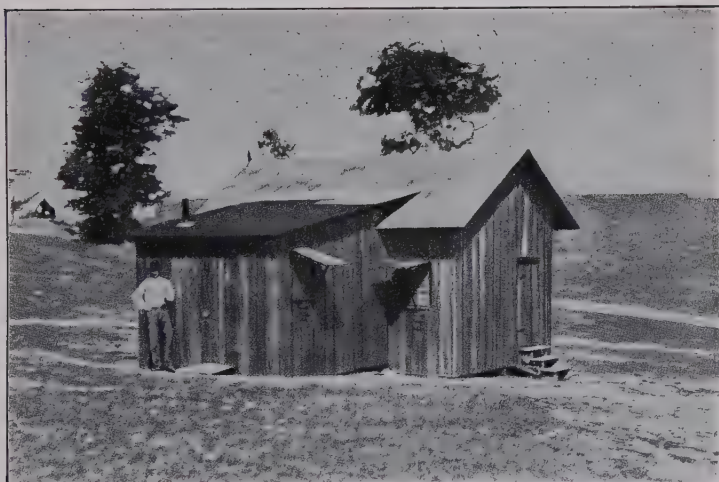
The discovery that malaria is not due to miasma or to poisonous air of any sort, but is transmitted from one person to another by a mosquito of the *anopheles* variety, was made by Major Ronald Ross, a surgeon of the British army, formerly in the India service and now connected with the Liverpool School of Tropical Medicine. He had been a careful student of the problem for several years, when in a series of experiments in 1898 he succeeded in infecting birds with malaria from the bites of mosquitoes. Later in the same year and in 1899, three Italian physicians, A. Bignami, G. Bastianelli, and B. Grassi, applying the methods of Ross, succeeded in infecting human beings. Major Ross and the same physicians had proved in previous experiments that men could not be infected with malaria with air or water brought from malarious localities.

Not only were these discoveries known several years before the task of sanitation was begun on the isthmus, but practical application had demonstrated the com-



From "Walter Reed and Yellow Fever," by H. A. Kelly.

Here the experiments with the yellow-fever mosquito were first carried out and the transmission of the disease by this means proved.



From "Walter Reed and Yellow Fever," by H. A. Kelly.

Building where the experiments were made which proved that yellow-fever is not transmitted by means of infected clothing (fomites).

Camp Lazear.

plete effectiveness of the new theories. The board of army surgeons that had conducted the experiments in Cuba drew up a set of regulations for the application of the new methods of fighting yellow fever in Havana, and these were put in force on February 15, 1901, by order of General Leonard Wood, and under the direction of Surgeon Major W. C. Gorgas, at that time chief sanitary officer of the city. The main features of the new methods were the segregation of all yellow fever patients behind wire screens and the fumigation of all infected houses. Success was immediate and convincing. Within three months yellow fever was banished from Havana, and for a period of fifty-four days the city was free of the disease. Subsequently there was an outbreak of it in the town of Santiago de las Vegas, a suburb of Havana, whence it was brought into the city, but strict and prompt application of the new methods in both places stamped it out within six weeks, and in the autumn of 1901, the period in which for many years the annual epidemic of yellow fever had been at its height, there was not a single case in Havana. There have been sporadic cases of it since from time to time, but these have been controlled easily and there has been no infection.

Application of suppression methods against the malaria mosquito, in accordance with the discovery of Doctor Ross, was made in Havana during the same period and with striking success. In 1900 the number of deaths from malaria in the city had been 325. In 1901, the year in which malaria mosquito work was begun, the number of deaths was reduced to 151, in

1902 to 77, and in 1903 to 45, which has been about the average annual rate since.

Immediately following the discovery of Major Ross, application of the new method of suppressing malaria was made in various parts of the world, notably in Egypt. The most striking success was that achieved under the personal direction of Major Ross, acting for the Suez Canal Company, at Ismailia. This is a town of 10,000 inhabitants on Lake Timsah, in Egypt, a small sea-water lake through which the Suez Canal passes. Originally a healthful town, it had become, through the formation of shallow marshes, defective drainage, and lack of sewerage, a hotbed of mosquitoes and of malaria. Nearly 2,000 cases were treated each year, and in 1901 there were nearly 2,500. By strict application of the new methods the disease was stamped out completely in three years, and the town has remained free from it since. The original outlay for the work was about ten thousand dollars, and the annual expenditure is about five thousand dollars. Similar results were achieved subsequently at Port Said.

Like all revolutionary discoveries, those of mosquito transmission were received with quite general incredulity, and even in the medical profession scepticism was by no means unusual. The most striking case of it was that of Colonel W. C. Gorgas, the man who was destined to win world-wide fame in applying the new methods. He was present in Cuba when the yellow fever experiments were made, and was a close witness of them; yet even after they had been concluded, and

Major Reed had declared the results in a paper which he read before the Pan-American Medical Congress at Havana, in February, 1901, Colonel Gorgas was still incredulous. Nothing but the success of the new methods which he himself had applied in Havana sufficed to remove his doubts, for in an official report of that work which he made to General Wood, under date of July 12, 1902, he said of Major Reed's paper of the previous year:

This idea was so new and so entirely contrary to all former theories on the subject, and apparently to all former experience, that the paper was received with scant belief. I myself had seen the work, and was convinced that the mosquito could convey yellow fever, but I was hardly prepared to believe that it was the only way, or even the ordinary way of conveying the disease . . .

I had very little hope of accomplishing much (in Havana); it seemed to me that even if the mosquito did convey yellow fever, he could not be gotten rid of, and, apparently, from all past experience, the mosquito was not the only way, or even the principal way, of conveying the disease; but, as he evidently could convey the disease, it was our duty to take precaution in this direction.

His conclusion, in view of his unexpected success, was that "the *stegomyia* mosquito is the only method of transmitting yellow fever—a fact proved by the army commission." In an address that he made three years later, before the Pan-American Medical Congress, at Panama, he said:

In time Reed's Army Board came along and made the astounding discovery that the mosquito alone conveyed yellow fever, and that dirt and filth had very little, if anything, to do with the question. My good friend, Dr. Finlay, some twenty years before had advanced this same theory, and during the twenty years preceding our occupation of the island had written and advocated the theory continuously. I had often heard him expound his views on the subject, but, like the Cuban woman, I smiled in a superior way at the "crazy Cuban doctor."

"The world requires," says Major Ross in the preface to his most interesting and valuable book,* "The Prevention of Malaria," "at least ten years to understand a new idea, however important or simple it may be. The mosquito theorem of malaria was at first ridiculed, and its application to the saving of human life treated with neglect, jealousy, and opposition." The same thing could be said of the mosquito theorem of yellow fever. In fact, when the American occupation of the isthmus began in 1904, comparatively few people in the United States were aware that the two discoveries had been made, and still fewer realized their inestimable value in the task of building the canal. It is a safe assertion that when the sanitation of the isthmus had been accomplished the general belief throughout the world was that the methods so successfully applied had been originated by those in charge of the work. It could not be said that the martyr Lazear and his heroic associates were forgotten; their deeds had never been known. It required the startling effect

* E. P. Dutton & Co., New York, 1910.

of a great success to awaken the world to a just sense of the priceless debt of gratitude that the human race owes to these modest, self-effacing surgeons and soldiers of the American army. To them belongs all the credit without division or diminution, for, as President Eliot, with that aptness of phrase of which he is so enviable a master, has said, they not only showed "how a fearful pestilence is communicated," but "how its ravages may be prevented." The showing was so clear that the sanitation of the isthmus or any other part of the tropics or of the world became a mere matter of intelligent administration.

CHAPTER XIII

ACTIVE WORK UNDER COLONEL GORGAS AND THE DEPARTMENT OF MUNICIPAL ENGINEERING — FINAL OUTBREAK AND ROUT OF YELLOW FEVER

PRESIDENT ROOSEVELT, who was fully aware of the value of the discoveries described in the preceding chapter, instructed the first canal commission to give special attention to sanitation, and to secure the best medical experts attainable for this purpose, saying further, in a letter to the Secretary of War, that "it is the belief of those who have noted the successful results secured by our army in Cuba in the obliteration of yellow fever in that island, that it is entirely feasible to banish the diseases that have heretofore caused most mortality on the isthmus." By unanimous consent, Colonel William C. Gorgas was the expert best fitted to take charge of the work. His close association with the army surgeons who had made the discoveries, and had formulated the new methods of applying them, gave him the practical experience necessary for intelligent administration. He had only to adopt on the isthmus the plans of the successful campaign in Cuba to win a second and more brilliant triumph.

Yellow fever was the special curse of the isthmus. Dread of that was the paramount obstacle in the way of canal construction. Malaria in its most deadly form, Chagres fever, was a scarcely less venomous foe

to health, but it excited far less fear. If yellow fever could be banished the canal could be built, in spite of malaria and all other tropical ills. The "astounding discovery" had shown, with a clearness that amounted to a revelation, that existing methods of fighting yellow fever were only so much wasted energy, and that the sure and only way to check and suppress it was to restrict the activity of the mosquitoes, and, so far as possible, suppress them.

Colonel Gorgas, who was familiar with the work of Major Ross in Ismailia and elsewhere, invited him to visit the isthmus, when the work of sanitation began in the summer of 1904, in order to have the benefit of his advice and suggestions, and the invitation was accepted, Major Ross making the visit as the guest of the canal commission. The work was begun, therefore, under most favorable conditions, with exact knowledge of what to do and with expert ability to guide in doing it. There was still another and scarcely less valuable aid to the task. Under the treaty with Panama the United States had sovereign power for health purposes not only in the Canal Zone, but in the cities of Colon and Panama, and could enforce all necessary regulations.

When the work began the whole isthmus was literally a mosquito paradise, with well-nigh ideal conditions for propagation and infection. The temperature being tropical, and scarcely varying at all the year round, allowed constant breeding, for which opportunities and facilities were virtually universal. During nine months of the year the innumerable stagnant pools of fresh water left by the almost constant rains afforded

the most favorable breeding-places possible for the malaria mosquito. In the dry season, there being no water-supply for cities and towns, the rain was stored in tanks and receptacles of various kinds, which made equally favorable breeding-places for the yellow fever mosquito. From one end of the Canal Zone to the other, a fifty-mile strip ten miles in width, tropical undergrowth flourished virtually undisturbed. Microscopical examination of the blood of the inhabitants showed that fully seventy per cent of the ten thousand or twelve thousand of them had the malarial parasite circulating in their blood. The malarial mosquito thus had a perpetual feeding-ground from which to obtain the seeds of infection. When a case of yellow fever occurred, the *stegomyia* was at hand, propagated often at the very bedside of the victim, to obtain and convey the infection.

The work of the American sanitary officers was thus clearly marked out for them. They must restrict the activities of the mosquitoes and, so far as possible, suppress them. The first needs were a water-supply and sewer system for the cities and towns, for until these were furnished existing methods of storing water could not be abolished. While these were being supplied houses could be screened and their inmates protected against infection.

Plans were adopted by the first commission almost immediately after its appointment for the construction of reservoirs to supply the cities of Panama and Colon with water, and later similar plans were adopted for all labor centres along the line of the canal. At the same time plans were adopted for a system of

sewers for the cities and the paving or resurfacing of their streets. This work, which was begun in the first six months of American occupation, was separate from the strictly sanitary work, and was performed by the Division of Municipal Engineering, which was under the general Department of Construction and Engineering, of which the chief engineer was the head. It was in existence till August 1, 1908, when, its work having been completed, it was abolished. During the four years of its activity it expended nearly \$6,000,000, of which about \$2,250,000 was for water-works, sewers, and pavements in the cities of Panama and Colon, and about \$3,500,000 was for work in the Canal Zone. Subsequent expenditures in Colon and Panama brought the total cost of improvements made in them by the commission up to nearly \$3,500,000. All of this, in accordance with the treaty between the United States and Panama, will be paid back to the United States, through water and sewerage rates, within a period of fifty years, at the expiration of which the system of water-works and sewers within city limits will revert to the cities, and the use of water will be free to their inhabitants, with the exception of a sufficient water rate necessary for maintenance and operation.

Through these expenditures pure water was supplied to the cities of Panama and Colon and all settlements in the Canal Zone, the cities were converted from hot-beds of disease, without water-supply or decent pavements or sewers, into the best-paved, best-watered, and best-sewered cities in Central or South America.

Moving side by side with the work of the Division of Municipal Engineering, though separate and distinct

from it, was the work of the Sanitary Department. The new methods of fighting disease, which had been shown to be effective by the mosquito tests in Cuba, were put into operation. Repairs and additions were made to the hospitals acquired from the French at Ancon and Colon, and emergency hospitals and sick-camps were established along the line of the canal.

The supreme test of the mosquito theory as applied to yellow fever came in 1905. When the Americans took possession of the Canal Zone in 1904 there were a few scattered cases of yellow fever, but as this was the usual condition between periodic epidemics of the disease, little concern was felt. In January, 1905, however, there was an increase in cases to 19, among whom there were 7 employes of the commission and Panama Railroad Company. Eight died, among them a canal employe. There were 14 cases in February, 11 in March, and 9 in April, and of these 18 were employes, 6 of whom died.

The 7 cases in April were among employes in the French administration building, which had become the headquarters of the commission in Panama, where about 300 Americans were engaged. When 3 of them died a panic arose among Americans on the isthmus, and all steamers outward bound were laden to the full capacity with frightened employes. An increase of the number of cases in May to 33, including 22 employes, 3 of whom died, and a further increase in June to 62, including 34 employes, 6 of whom died, added to the panic, and nothing except lack of sailing accommodations prevented the scattering of the entire force. In July the number of cases began to decline,

showing that the progress of the disease had been checked, and a further decline in August partially restored confidence. By the first of September the disease was shown to be under control, and in December the last case was registered and there was no death. There had been among employes of the commission and Panama Railroad employes 133 cases and 35 deaths. As this epidemic was the last of its kind on the isthmus, the full record of it is given:

STATISTICS OF THE LAST YELLOW-FEVER EPIDEMIC ON
THE ISTHMUS, 1904-5

MONTH	TOTAL		EMPLOYES		PLACE OF ORIGIN			
	CASES	DEATHS	CASES	DEATHS	PANAMA	COLON	CANAL ZONE	FOREIGN PORTS
1904								
July.....	2	2	2	2	2	..	..	..
August....	..	..	..	..	..	..	..	..
September..	1	..	..	..	1	..	..	..
October....	2	..	..	..	1	1	..	..
November..	2	..	1	..	2	..	..	..
December..	6	1	2	..	5	1	..	..
1905								
January...	19	8	7	1	8	1	1	9
February..	14	9	5	3	10	..	2	2
March.....	11	3	6	..	7	4	..	..
April.....	9	3	7	3	8	1	..	..
May.....	33	7	22	3	16	14	3	..
June.....	62	19	34	6	29	17	13	3
July.....	42	13	27	10	15	9	8	10
August....	27	9	12	1	11	10	5	1
September..	7	4	3	3	5	..	1	1
October...	5	3	3	2	4	1	..	..
November..	3	3	1	1	1	2	..	..
December..	1	..	1	..	..	1	..	..
Totals.	246	84	133	35	125	62	33	26

In applying the new methods of fighting the disease, Colonel Gorgas had the hearty co-operation and earnest support of Charles E. Magoon, who, as member of the second Isthmian Canal Commission, which had succeeded the first commission on April 3, 1905, was governor of the Canal Zone when the yellow-fever epidemic began to gain headway. Governor Magoon, immediately upon his arrival on the isthmus on May 24, assured Colonel Gorgas that the entire resources of the commission and the government of the Canal Zone were available for the work of stamping out yellow fever on the isthmus. Under the joint labors of these two officials the cities of Panama and Colon were fumigated house by house, the towns of the Canal Zone were divided into districts for the extermination of mosquitoes, medical inspectors were appointed to make daily house-to-house canvasses and to report all suspected cases, and all such were taken at once, willingly or unwillingly, to the hospitals and segregated.

At the same time that these vigorous measures were being applied a rigid quarantine, which had been established at the outset of American occupation, was maintained against all infected ports, preventing the introduction of disease from outside.

Since December, 1905, there has been no case of yellow fever on the isthmus which has originated there. There have been sporadic cases from time to time, but invariably of persons who have brought the disease from outside the isthmus. In each instance the victim has been segregated and there has been no infection.

CHAPTER XIV

COMPLETENESS OF THE VICTORY OVER YELLOW FEVER — REWARDS GIVEN BY CONGRESS TO THE MEN WHO MADE IT POSSIBLE

THE utter and final rout of yellow fever was the most convincing demonstration yet made of the truth of the theory of mosquito transmission. No rational person could thenceforth question either the truth or the limitless beneficence of the discoveries made in Cuba in 1900. Colonel Gorgas has borne emphatic testimony on that point. In an article which he published in the *Medical Record* of May 18, 1907, he said:

I do not believe that our present freedom from yellow fever is in any way accidental. Our work here, I think, is another evidence of the great obligation mankind is under to the Army Board, of which Major Walter Reed was chairman and Lazear and Carroll were members, for establishing the fact that the *stegomyia* mosquito was the transmitter of yellow fever. Without this knowledge I do not believe we could have done any better than did the French, and judging from the alarm that was caused by the comparatively mild epidemic which we had among our employes in 1905, I doubt, in case we were having the same amount of yellow fever that the French had, whether we could keep a sufficient force of white employes here to carry on the work. And even if we could keep white employes here under such circumstances I doubt whether public

sentiment in the United States would allow the canal to be built at such a sacrifice of human life.

In that opinion all competent authorities must agree. Reed, Carroll, and Lazear, the last-named at the cost of his life, made possible the Panama Canal. Whatever honors may be awarded to those who took part in the work of actual construction, the first honor must be awarded to them. Their discovery, of incalculable value to human welfare and progress, was a direct outcome of the war between the United States and Spain, and will go far to justify the claim that that contest was a war in the interest of humanity.

What recognition have these brave men received for their services? Lazear left a wife and two small children, one of them born a few months before his death and never seen by him. Congress appropriated for his widow the magnificent pension of \$17 a month, with \$2 additional for each child until the age of 16! This was continued till May, 1908, when it was replaced with an annuity of \$125 a month. A battery in Baltimore harbor has been named in his honor, and a tablet to his memory has been placed in Johns Hopkins Hospital, at Baltimore.

Reed died in Washington, November 23, 1902. In March, 1903, a pension of \$125 a month was granted to his widow. This was so inadequate for her support, that a Walter Reed Memorial Association was formed, and a fund of \$25,000 was raised, the interest of which, \$75 a month, is to be paid to her during life, and the principal used to erect a memorial to him after her death. A hospital in Washington has been named in his honor.

Carroll died in Washington, September 16, 1907.

In May, 1908, Congress granted his widow a pension of \$125 a month.

Kissinger's health failed so completely a few years ago that he was dependent on his wife for support. Application was made to Congress for a pension, and the response, in March, 1907, was a grant of \$12 a month. Application was made again in 1910, Kissinger being then a hopeless paralytic, and a grant of a pension of \$125 a month was passed by the Senate, but was objected to by the committee on pensions in the House because "in carrying a rate in excess of that allowed to any other private soldier" it would establish a vexing precedent. In February, 1911, the House cut down the amount of the pension to \$100 and passed the grant.

In granting the \$125 pension for Lazear's widow, Congress declared that it was bestowed "in special recognition of the eminent services of the said Jesse W. Lazear in discovering the means of preventing as well as the cause and method of transmission and propagation of yellow fever and demonstrating on his own person the truth of the theory of the transmission by mosquitoes, and the sacrificing of his life in proving the same." The same language was used in the grant to Carroll's widow, with the final clause omitted. In the grant to Kissinger, the pension is awarded "in special recognition of his eminent services rendered, suffered, and endured, and permanent disabilities contracted in the interest of humanity and science as a volunteer subject for experimentation in the yellow-fever hospital in Cuba."

There is a sad discrepancy here between the verbal

and the pecuniary appreciations of the service rendered. Not only did that service make the building of the Panama Canal possible, but it abolished forever from the United States a scourge that during more than a century had, through periodic outbreaks, cost it a half million lives and many millions of dollars. Ninety times during that period had yellow-fever epidemics invaded American cities from Philadelphia and New York to New Orleans, carrying in their wake terror, devastation, and death, paralyzing industry and business, and filling the whole land with alarm. One epidemic alone, that of 1878, in the Mississippi valley, caused nearly sixteen thousand deaths, and inflicted upon the country a loss that has been estimated at one hundred million dollars.

When Jenner discovered vaccination he received from the British government grants amounting to above \$150,000, and also a subscription fund of \$35,000 dollars raised in India. This was a hundred years ago, and the discovery, scarcely more valuable to human welfare than that of yellow-fever transmission, was made without risk of life to the discoverer.

As for Moran, he suffered no ill effects from the disease, and has never been an applicant for government or other aid. His ambition had been to become a physician, and in accordance with it he entered the University of Virginia as a medical student in 1901. He was compelled to discontinue his studies a year later through lack of funds. Since 1904 he has been in the service of the canal commission, in the Department of Sanitation, holding various positions and filling all of them with efficiency and with unvarying modesty.

CHAPTER XV

WARFARE UPON MALARIA — COST OF MAKING THE ISTHMUS HEALTHFUL—IS IT A HEALTH RESORT ?

WITH yellow fever banished from the isthmus, the Department of Sanitation was able to devote its entire energies to the task of restricting the ravages of malaria. The possibility of banishing that disease was too remote to be entertained. The problem was a very different one from that of yellow fever. A victim of yellow fever either recovers or dies. In either event he ceases to be a source of germ supply for the *stegomyia*, and without such a source the *stegomyia* becomes an entirely harmless mosquito. She—for the female alone transmits the disease—has nothing to carry. The life period of this mosquito is not known. In captivity it is seldom more than five weeks, though there are records of infection from its bites at intervals ranging from twelve to fifty-seven days after contamination. It is a house mosquito, cannot live without water, and is easily destroyed by fumigation. If there is no fresh case of yellow fever within a period of sixty days after the latest one in an epidemic, it is a safe conclusion that the disease has been stamped out, because there is no mosquito alive to carry the parasite. After a period of ninety days all doubt on

the subject ends. A community infested with *stegomyia* can live in absolute security from yellow fever unless a case be brought in from outside. As a matter of fact, the measures applied against this mosquito in the Canal Zone were so effective that during the past year or more an adult *stegomyia* has been so rare as to be regarded as a curiosity.

But with the *anopheles* it is quite another matter. This mosquito breeds in the country districts, in marshes, pools, and stagnant water of all kinds. Furthermore, a victim of malaria seldom dies of the disease, but is capable of infecting mosquitoes with it for three years, or at every recurrence of it. With a population, seventy per cent of whom had malaria in their systems, and with a fifty-mile strip of country ten miles in width breeding mosquitoes in nearly every part, the abolition of malaria was clearly an impossibility. But if it could not be abolished its volume could be reduced, and this task was undertaken with great zeal, practically unlimited resources, and on lines of demonstrated effectiveness.

The task would have been hopeless from the outset had it been necessary to extend anti-mosquito operations over the entire territory of the Canal Zone, comprising 278,848 acres. The work of the Sanitary Department has been confined to the portions occupied by the canal forces, and these aggregate only about 1,200 acres. These were cleared of undergrowth of all kinds for a distance of 200 yards around settlements, the grass over that area was kept less than a foot in height, marshes and swamps were drained, stagnant

pools were oiled regularly to kill mosquito larvæ, and all buildings were screened. In this work there had been expended down to June 30, 1912, for sanitation proper, \$3,644,000. If it cost this sum to create desirable sanitary conditions in 1,200 acres of the Canal Zone, what would it have cost to accomplish like results in 278,848 acres? Happily, no such herculean task was necessary to make canal construction possible.

So successful were these measures that within two years mosquitoes were so nearly exterminated in the occupied sections of the Canal Zone that during the dry seasons one was rarely seen or heard, and from that time till the present a steady diminution in malaria cases has been recorded, the average number at present being about one-third as large as that at the beginning of the work. In the rainy season the task of preventing mosquito breeding is much more difficult, and there is uniformly a larger number of malaria cases in consequence. In fact it has been made apparent that the final extirpation of *anopheles* mosquitoes is an impossibility. Nothing but unceasing warfare suffices to keep the number of them restricted. They reappear in undiminished hordes as soon as efforts for their suppression are relaxed, showing that the cost of keeping them in subjection must be a permanent annual expenditure. A very valuable result of the restrictive work has been the demonstration, conclusive and convincing, that the mosquito, and the mosquito alone, transmits malaria, that the disease is not due to marsh miasma or poisonous air of any sort.

When the canal shall have been completed and opened to the shipping of the world on Jan. 1, 1915, the health bill which the United States will have had to pay in connection with its construction will be very close to \$20,000,000. Down to the end of the calendar year of 1912 the total expenditures of the Department of Sanitation aggregated about \$15,500,000. Adding to this sum the \$2,500,000 expended for water-works, sewers, etc., in the Canal Zone, we have a total for general health purposes of \$18,000,000. The expenditures of the final two years will bring the amount to nearly or quite \$20,000,000. It will have cost the United States Government this sum, first, to make the isthmus a normally healthy place in which to live and work; second, to maintain it in that condition; and third, to care for the sick, the injured, the insane, etc.

Under the title "Department of Sanitation" there has been grouped on the isthmus all the work done in the interest of health, both in the Canal Zone and in the cities of Panama and Colon—sanitation proper, hospitals, quarantine, street-cleaning, garbage collection, etc. For sanitation proper there will have been expended when the canal is thrown open formally to the commerce of the world about \$6,000,000. Of this amount over \$3,550,000 was spent during the first five years of American occupation. The average force of the department during most of that period was about 3,000 men, and the average annual expense about \$710,000. During the next three years the annual average expense was about \$488,000. At present it is very near

the latter sum. These figures include certain overhead charges which are imposed proportionately upon all departments of canal work.

By far the largest item of health expenditure has been for hospitals or general care of the sick. This, when the outlay for construction and repair of buildings is included, will aggregate on January 1, 1915, very nearly \$9,000,000; that for all other branches of the health service, about \$7,500,000; and that for general administration of the department, close to \$1,000,000. Adding to these items the \$2,500,000 spent for water-works, sewers, etc., in the Canal Zone, we have the \$20,000,000 total. The average annual outlay for all health purposes on the isthmus during the ten and one-half years of canal construction will have been, therefore, about \$1,900,000, and for sanitation proper about \$570,000.¹

Has this expenditure made the isthmus a "health resort"? In the full sense of the term, it has not. It has made it a reasonably healthful place of abode and work, and an agreeable and healthful place of sojourn, especially during the three months of the dry season. But this will remain true of the isthmus only so long as stringent methods of health protection are enforced. Health statistics of the Canal Zone—sick and death rates—are misleading when used in comparison with like data of communities in the temperate zone, unless

¹All figures cited, relating to expenditures by the department of sanitation, were furnished to me by Col. Gorgas, the chief of the department, who obtained them from the examiner of accounts, the first authority in the commission for all expenditures. Their absolute accuracy is not to be questioned—J. B. B.

the peculiar conditions on the isthmus are taken into account.

In the first place, the American colony in the Canal Zone is a selected white community, with less than the average allotment of women and children. All applicants for employment are required to be in good physical condition, and all who are unable to maintain such condition after employment are deported. Thus the American force is composed at all times of men who have shown themselves able to withstand the climate without serious disability, and the colony is rid of a permanently sick or incapable class. Furthermore, there are no aged and infirm persons to swell the sick and death rates.

In the second place, the health of the American colony is cared for as that of no other community on earth ever has been. Its members are provided with comfortable and healthful furnished quarters, free of rent, constructed on sanitary principles, and supplied with pure water. If one of them falls sick, he can obtain free medicines, free medical or surgical attendance, and, if taken to a hospital, free subsistence while there, and full pay, provided the period of his absence from work does not exceed thirty days in a year. His dwelling-place is cared for at the public expense, and all sanitary regulations in regard to it are rigorously enforced. He lives, in short, under a system of compulsory health preservation which protects his physical condition on every side. In addition to all this, he is granted six weeks' vacation each year with full pay in order that he may go to a more

bracing climate and thus escape the deteriorating effects of the tropics.

All these things must be taken into account in considering the question of the healthfulness of the isthmus and of the tropics in general, and the allied question of making the tropics as healthful a region for the white man, or the Anglo-Saxon, as the temperate zone is. Undoubtedly, the application of the methods employed in the Canal Zone to any other section of the tropics would produce like results; that fact has been clearly demonstrated, but such application requires for success the presence behind it of a rich and powerful government as willing to defray the cost as the United States Government has been in the case of the isthmus. Some white men can undoubtedly maintain as good a condition of health in the tropics, under the methods of health protection enforced at Panama, as the same men would have been able to maintain in the temperate zone, but many others cannot. This has been demonstrated clearly on the isthmus. The visitor to the canal sees the hardy, healthy-looking Americans who have been able to remain on the job, and judges of the healthfulness of the country from them, but he does not see those who have been obliged to return to the United States because they could not withstand the climate, and there have been a great many of these.

The curse of the isthmus is malaria, and until the *anopheles* mosquito shall have been annihilated this will remain. The warfare made against it during six years has greatly mitigated its ravages, but it still re-

mains in formidable force. As I have said, the number of cases has been reduced about one-third during these six years; yet after this reduction there were, among about 40,000 employes during the fiscal year ending June 30, 1912, over 7,000 cases in the hospitals, with 32 deaths: 22 whites, 4 of whom were Americans, and 10 blacks. Since the beginning of American occupation, in 1904, 47 Americans have died of malaria, 35 of whom were men, 3 women, and 11 children. It is rarely a fatal disease among Americans, but its effect is great physical weakness and depression and often lifelong debilitation. Constant care in the manner of living, remaining behind screens at night, and taking liberal doses of quinine at more or less regular intervals are necessary safeguards. Many persons live for years on the isthmus without being infected by it. I have lived there with my wife and daughter for more than six years, and none of us has had a touch of it, but every clerk that I have had in my office during that time has had it, though all of them occupied screened quarters. During these six years, beginning with 1906, the Sanitary Department has distributed free among employes 15,600 pounds avoirdupois of quinine, 109,200,000 grains, an average of 2,600 pounds, 18,200,000 grains, a year.

The death-roll among employes from all diseases from the beginning of American occupancy to the end of the fiscal year 1912, eight years, was 5,141, of which number 284 were Americans; 4,119 died of disease and 1,022 from violence or accident connected with the work. There were also during that period 49

deaths of American women and 87 deaths of American children. The most reasonable estimate of deaths among the French during the nine years of their occupancy is about 16,000, or a little more than three times that of the Americans during eight years.

CHAPTER XVI

THE EVOLUTION OF "A BENEVOLENT DESPOTISM" — INDUCEMENTS TO ENTER THE CANAL SERVICE

"WHERE," asked a British colonial governor who was visiting a canal official on the isthmus, and was examining with many expressions of surprise and approval the screened, wide-verandahed, airy dwelling in which he was received, "where did you get this type of house?" The official replied that it was the result of American ingenuity applied to the needs of the situation. The needs of the situation being novel, novel methods of meeting them had been invented. The demand was for a house suitable for life in the tropics and at the same time constructed and equipped in accordance with the modern ideas of comfortable living prevailing in the United States and with modern ideas in sanitary science. By process of evolution there was developed a type of building which met the requirements of the situation in every respect.

What is true of the dwellings is true of all features of the canal work on the isthmus, from the dominating, autocratic government down to the housing and feeding of the common laborers. All are the results of a process of evolution, of the application of American intelligence and ingenuity to the needs of the situa-

tion. The nation was confronted with a task, not only unprecedented in magnitude, but unprecedented also in the conditions and surroundings in which it must be performed. Its own experience afforded no light for guidance and the experience of other nations nothing except the dismal warnings of disaster.

A clear conception of this situation at the outset is necessary for a proper understanding of why there was built up in the Canal Zone a system of control which has been styled variously "paternalism," "modified socialism," and "benevolent despotism." It was not the work of a month or a year, but a gradual evolution, the outgrowth of practical experience, covering several years.

Congress, building better than it knew, perhaps, left the direction of the great work entirely in the hands of President Roosevelt. It empowered him, through the law known as the Spooner Act, to construct the canal through a commission of seven members selected in accordance with certain requirements as to personnel. In a separate act it conferred upon him all the military, civil, and judicial powers as well as the power to make all rules and regulations necessary for the government of the Canal Zone, which powers he was to exercise through such persons as he might choose and in such manner as he might direct. He was authorized to exercise these powers till the expiration of the Fifty-eighth Congress; that is, from the date of the act, April 28, 1904, down to March 4, 1905, when the Congress named expired. That Congress went out of existence without taking further action in the matter,

thus leaving the President without congressional authority to continue the exercise of those powers which it had conferred in the act of 1904, and under which he had established a form of government in the Canal Zone, using the canal commission as a legislative body. As he was directed to construct the canal, as the maintenance of a government in the Canal Zone was essential to such construction, and as there was an existing government bound by existing laws which continued in effect, though the power to make or to amend them had ceased, the President decided that it was his duty, under his constitutional obligation, to see to it that the laws were enforced and that the established government carried out its functions as limited by legislative acts.

Through this failure of Congress to continue the legislation which it had enacted at the outset, the government of the Canal Zone, as well as the direction of the canal work, passed entirely into the hands of the President, and rule by executive order, rather than through legislative action by Congress or by the canal commission, was established over the canal work. Nothing more beneficial to that work could have happened. It substituted prompt action in place of indefinite delay in all matters of pressing importance. How valuable this was to the successful prosecution of the task will be made apparent as this narrative proceeds.

As has been said in a previous chapter, when the Americans took possession of the Canal Zone, in the spring of 1904, it was virtually the universal belief in

the United States, and indeed throughout the civilized world, that every person who ventured to go to the isthmus did so at the peril of health and life. Scarcely had a small force been assembled when the outbreak of yellow fever came, in 1905, confirming the universal dread and making the task of assembling a competent force more difficult than ever. The fact that the pestilence had been checked and overcome through the application of newly discovered methods of suppressing it commanded far less public attention than the fact that thirty-five American employes had died of it. The gloomy reports of panic-stricken survivors who had been able to get back to the United States, and equally gloomy letters from their less fortunate associates who remained behind and were determined to get away at the first opportunity, had a wide hearing and intensified the original dread. These eye-witnesses of pestilence in action, who had seen their companions stricken at their side, spoke with the awful authority that terror alone can supply. They had escaped the supreme peril, but many of them were the victims of malaria, with its debilitating and depressing effects, and were sad examples of what the isthmus climate could do to the health of a sojourner from the temperate zone.

It was evident that extraordinary inducements must be offered to persuade competent and satisfactory persons to enter the canal service, in the first place, and other extraordinary inducements to persuade them to remain there after arrival. They must be given wages considerably in advance of those paid at home. They

must be provided with living quarters that were not merely satisfactory, but to some extent attractive. They must be provided also with a food supply similar to that to which they had been accustomed. Quarters and food must be furnished also on terms so low as not to offset the higher wages. There were no suitable quarters on the isthmus, no food supply worth considering, and no supply of the ordinary necessities of life that was at all adequate, and what there was could be obtained only at exorbitant prices.

In fact, the isthmus was a barren land so far as its ability to supply the vital, pressing needs of the invading army of American canal workers was concerned. There was no adequate base of supply nearer than two thousand miles by water, and no competent agency of supply and transportation except the United States Government. The canal force was precisely in the position of an army in the field two thousand miles from the base of supply. It had been sent there by the government, it was to be paid by the government, it was to be ruled by the government, and it must be housed, fed, clothed, and cared for in all respects by the government. There was no escape from this, for no other method of care was possible. In due time it was to become clear that, being an army in the field, it must be ruled like an army—that is, by autocratic power.

The first canal commission began its efforts to assemble a force by authorizing the payment of the same wages and salaries that the French canal company had paid, but it soon discovered that satisfac-

tory service could not be secured in that way. Higher rates were offered, but the response was still unsatisfactory. Special inducements were added one after another, until an established system was developed which contained perquisites and gratuities which in number and value far exceeded anything of the kind bestowed upon a working force elsewhere on the face of the globe.

Inducements to enter the service included salaries and wages from twenty-five per cent to one hundred per cent above those paid in similar employments in the United States; free transportation from the United States to the isthmus to all new employes and reduced transportation for their families; free furnished quarters, with free fuel, light, and water; free hospital and medical service, and thirty days of sick leave with pay each year; six weeks' vacation with pay each year, with reduced transportation to and from the United States for salaried employes and their families; privilege for all employes to buy at commission commissaries provisions, clothing, and other necessary supplies at final cost prices, and to obtain meals at commission hotels, mess-houses, and kitchens at like prices.

Like all other features of canal management, these inducements were the result of evolution. Quarters had to be supplied because none existed. These had to be equipped with furniture and household articles because employes could not be expected to bring these from the United States, and they could not be bought on the isthmus, even if employes had been willing to go to that expense. Furthermore, if furnished by the

government, they were kept in that condition through all changes of occupants. Being the property of the government, they must be under governmental supervision at all times, both for maintenance and conformity to sanitary regulation, so that care and repairs must be paid for by the government. Fuel, water, and light must be supplied by the government because obtainable in no other way. They were a part of the system of supply and control of the commission, and the question of making occupants pay for them was never seriously considered.

CHAPTER XVII

ESTABLISHING A FOOD SUPPLY AND ASSEMBLING A LABOR FORCE

IN the evolution of a system of food supply an interesting experiment was made. There had been on the isthmus for several years when the canal work began a commissary store operated by the Panama Railroad Company for the benefit of its employes. This was used for a time by the commission as a base of supplies for hotels and mess-houses in labor camps and other settlements of employes, but as the force grew in size it also became evident that a more comprehensive system must be devised, and, as the commission had so many other pressing problems on its hands, it was suggested by Mr. Wallace, the first chief engineer, who had had large experience in railway construction camps in which employes were fed by a private contractor, that the same method might be advisable on the isthmus. In accordance with this suggestion, bids were asked for in the summer of 1905, and in September of that year a contract was awarded by the Panama Railroad Company to the lowest bidder. When the prices at which the contractor agreed to furnish meals to employes were made public on the isthmus, they were seen to be considerably higher than those hitherto

paid, and at once a vigorous protest was made by the employes, and Mr. Stevens, who had succeeded Mr. Wallace as chief engineer, sent a cable message to the canal commission at Washington, saying that if he had that contract he would guarantee to make a million dollars a year under it. The contract was annulled by mutual consent before being put into operation, and no effort was made to obtain another.

During the period in which the matter had been under discussion the conclusion had been reached by Mr. Stevens and his associates that the government could furnish food at lower rates than were possible under a contract, for the simple reason that the government did not seek a profit on the business, while a profit was the only inducement which led a contractor to undertake it. Furthermore, the government could obtain supplies at lower prices than a private contractor could, and through its ownership of the Panama Railroad Steamship Line could get lower rates of transportation. This was the first of several demonstrations destined to be made as the canal work advanced of the superior advantages possessed by the government over private operators or contractors both in the performance of the work itself and in the care of those who were engaged in it.

With the abandonment of the private-contract plan of food supply, the commission turned its attention to the enlargement and perfecting of its existing system. It had the steamers of the Panama Railroad Steamship Line equipped with cold-storage facilities, established a cold-storage plant at Cristobal, ordered

refrigerator cars for the Panama Railroad, entered into large contracts for meat and other food supplies, increased its hotels and mess-houses along the line until there was one in every settlement of employes, and within a year had an unbroken line of cold-storage provision supply between the markets of New York, Chicago, and New Orleans and the hotels, mess-houses, and dwellings of the Canal Zone. Within the same period it took possession of and enlarged the Panama Railroad commissary, converting it into a large modern department store, opened branch stores in all the larger line settlements, established a bakery and a laundry, and began the construction of warehouses for the storing of provisions at Cristobal. Later an ice-cream plant, coffee-roasting plant, and other features were added.

During the most active years of canal construction, when the force was at its maximum, the government, acting through the Commissary and Subsistence Department of the canal commission, was housing, feeding, and, in large degree, clothing and providing with all necessities of life nearly sixty-five thousand persons. This was about the number of employes and their families or dependents. It maintained a central commissary, or department store, and about twenty branch stores in as many villages and settlements of the Canal Zone. It operated the Hotel Tivoli, a public hotel with modern facilities and accommodations for five hundred guests; about twenty line hotels for American employes; and about the same number each of mess-houses and kitchens for common laborers. It did

a business of about seven million dollars annually and was self-sustaining.

There is a steady diminution in the volume of business as the canal nears completion and the force is reduced, but the system continues in operation unchanged and will continue till the end. When the canal is thrown open to commerce the plant will be used by the government to furnish supplies to the operating force, the isthmus military establishment, the United States naval vessels, and all passing ships which desire to purchase them.

Every morning at four o'clock a supply train starts across the isthmus from Cristobal, made up of refrigerator and ordinary freight cars carrying ice, cold-storage, and other supplies. These are delivered at the stations along the line between the Atlantic and Pacific, and by the local quartermasters are taken to the hotels, mess-houses, and dwellings of the employes.

Prices in general have been, and still are, lower than those prevailing in the United States, because supplies are purchased on very large contracts, awarded on open competitive bidding, and no profit is sought by the government. The only addition to the original wholesale cost is the actual expense of transportation, handling, and delivery. The business is managed as closely as possible so as to make both ends meet. Previous to January 1, 1912, whenever a profit resulted, which was not always the outcome of a year's operations, it was turned into a sinking-fund to pay off the cost of cold-storage and other plants. This aggregated \$688,000, and was all paid off by the end of 1911. Since

that time, whenever a profit is shown the consumer is given either a reduction in prices or an improvement in the quality of supplies.

The net resulting benefit has been that the employes of the canal commission have been obtaining, during the past six years, their food and other supplies at prices considerably lower than those prevailing in the United States, and consequently have suffered less than their fellow-countrymen at home from the "high cost of living." This is especially true in the item of beef and meats in general. While the price of beef was soaring steadily upward in 1911 and 1912, the canal employes were paying the same price that they had paid during the preceding year. This was partly due to the system of purchase on large contracts and partly to the ability of the Subsistence Department, through its control of all supplies, to equalize prices in such a way as to raise the lowest and maintain the highest unchanged.

When the contract plan was under consideration, in 1905, the price of meals in hotels for American employes that was named in the accepted contract was thirty dollars a month, and that named for all common laborers was forty cents a day for three meals. Notwithstanding the advance in prices which has been in quite steady progress since that time, the canal commission has maintained its price, fixed in 1905, of thirty cents a meal for American employes and has improved the quality. The price for European laborers, who are mainly Spaniards and Italians, is forty cents a day for three meals, and for West Indian la-

borers twenty-seven cents a day. The ability to maintain these prices, while increasing the quantity and improving the quality of the food, demonstrates clearly the superior advantages possessed by the government over the private contractor as a caterer, and vindicates the judgment of the canal commission in the course which it adopted.

Following closely upon the decision in regard to the supply of food and other necessities, the canal commission took up the question of labor supply. When the Americans arrived on the isthmus, in 1904, there was no labor available except that of West Indians. There was a force of about seven hundred men, nominally in employment by the reorganized French company, but it was incompetent and inadequate. To attempt to construct the canal with West Indian labor alone was to invite indefinite delay in the time of completion. More efficient labor must be sought elsewhere. The first proposition was to secure Chinese. This was viewed with so much favor that the commission, in August, 1906, asked for proposals to furnish twenty-five hundred Chinese laborers for a period of not less than two years, with the privilege of increasing the number to fifteen thousand. Four bids were offered, two of which complied with the terms specified and agreed to supply the labor at prices very much lower than those which the commission paid subsequently to other labor. There was, however, a great outcry raised in the United States against the employment of Chinese, and partly because of this, and partly because of certain undesirable conditions

accompanying the bids all were rejected and the plan was abandoned.

The commission thereupon, in October, 1906, issued invitations for proposals to have the work done by groups of contractors, the work to be divided into two or more sections, and each group of contractors to be composed of men who had achieved conspicuous success in their profession. The idea was to secure for the canal the services of contractors who had had experience in large railway construction work and who would take to the isthmus their gangs of trained laborers. The successful bidders were to be paid an agreed percentage on the work done, the government furnishing the capital. Several bids were received, but when they were opened, on January 1, 1907, none of them was found to be satisfactory, and a call for new proposals was issued. Before answers to the second call were received President Roosevelt decreed that the plan should be abandoned.

In taking this action he proceeded in accordance with the views of Mr. Stevens, the chief engineer. When the plan was first proposed Mr. Stevens favored it as offering the most available means of obtaining an efficient working force. While it was under discussion, however, certain tentative arrangements for collecting a force had been put in operation and had proved successful. The chief of these was the importation of laborers from northern Spain. These became the nucleus of an efficient force, and soon after the bids of contractors had been opened Mr. Stevens had become convinced that a force could be assem-

bled by the commission, without the aid of the railway contractors, that would be as efficient as any that they might supply, and that with its own force the government could do the work more cheaply than would be possible under a contract system. Experience has fully justified this opinion and the action of President Roosevelt in accordance with it.

The working force which Mr. Stevens began to assemble in 1906 grew steadily and rapidly into a high condition of efficiency that was maintained undiminished during the entire period of active construction, and was surpassed by that of no other labor force anywhere and equalled by few. With this force at its command, with the unlimited capital and credit of the United States Government behind it, and with the entire canal work and administration under a single, all-powerful head, the commission was enabled to accomplish its task, not only more quickly and more cheaply than would have been possible under a contract plan, but in a manner so excellent in every part as to be beyond successful criticism. So clearly was the superiority of government operation demonstrated that contractors who had made bids for the work and who visited the isthmus a few years later declared frankly that not only was the work better done than they could have done it, but that if they had been intrusted with the task the outcome would have been failure and financial ruin for themselves.

CHAPTER XVIII

PROVISIONS FOR THE COMFORT AND CONTENTMENT OF THE FORCE — CLUB-HOUSES AND OTHER AGENCIES

By process of evolution through practical experience, the government, as shown in preceding chapters, acting through the canal commission, having been compelled, through necessity, to provide living quarters for a canal force, and, through sound economic reasons, to establish and operate its own system of food and other necessary supplies, was compelled to assemble its own force of laborers and take into its own hands the work of construction.

After these problems had been solved there remained still another that from the outset had been pressing for solution. This was to induce the Americans who composed the clerical, subordinate engineering, and skilled mechanical elements of the force to remain in the service after arrival. During the first two years the annual changes in these occupations was ninety per cent. It was clearly impossible to attain to anything like efficiency under such conditions or to hope for anything approximating a permanent force. After a few months on the isthmus the great majority of American employes became discontented and de-

pressed, lost interest in their work, and had no other ambition than to "get back to God's country" at the earliest opportunity. There were abundant reasons for this. Life on the isthmus was without relief or diversion of any kind. There were no reputable places of amusement, no clubs, libraries, or reading-rooms. The only distractions from the constant dread of sickness and the inevitable loneliness of existence in a land not merely foreign but lacking in most of the familiar comforts of modern civilization, were vicious and degrading. It was evident that means must be devised to supply opportunities for amusement and recreation, and early in 1906 the second canal commission, with the cordial co-operation of President Roosevelt and Secretary Taft, took up the question of providing them. Efforts in these directions had been made by the employes themselves, but lack of adequate means had prevented these from assuming more than very modest dimensions.

It was first thought by the commission that it would be sufficient to build club-houses or recreation buildings for the employes and leave to them the task of furnishing and maintaining them, but this was found to be impracticable because the furnishing alone was far beyond the means of the employes. Gradually the commission enlarged its benefits, till finally it provided for five of the principal centres of workers large buildings, fully furnished, at a total cost of thirty-five thousand dollars each. These contained an assembly-room, a billiard and pool room, reading-room, bowling-alleys, and other features of similar institutions in

the United States. Smaller buildings, with less expensive equipment, were erected later at minor points.

The supreme value of the direct system of government through executive order in the canal work was demonstrated when the question of spending the necessary money for the erection and equipment of these club-houses came before the commission. Doubt was expressed as to whether it was a proper and lawful use of the funds appropriated for canal construction. If they were to be erected in time to be of service, they should be authorized immediately and work upon them should be begun at the earliest possible moment. Delay for any length of time would be fatal. The question was taken to President Roosevelt and the situation was explained to him. He directed that the expenditure be authorized at once and erection be begun, saying that if objection were raised later, and the propriety of the use of the money were questioned, he would appeal to Congress for a special appropriation to cover the cost. As a matter of fact, no objection was ever made. If it had been necessary to refer the question of expenditure to Congress for decision, indefinite delay would have been the inevitable outcome, with strong probability of an inadequate appropriation in the end, and in the meantime the beneficial effect which the club-houses began to exercise as soon as opened upon the contentment and well-being of the force and the resulting increase in permanency and efficiency would have been lost.

By direction also of President Roosevelt the Young Men's Christian Association, because of its large ex-

perience in work of this kind in the United States, was asked by the commission to take the management of the club-houses, under the supervision of an advisory committee appointed by the commission. The International Committee of the Y. M. C. A. sent trained workers to the isthmus for this duty. Their salaries were paid by the commission, with the approval of President Roosevelt. For the large club-houses libraries of six hundred volumes each were purchased by direction of the President through the Secretary of War. All employes on the "gold roll," who were virtually all white Americans, were eligible to membership on payment, at first, of one dollar a month, subsequently ten dollars a year. The revenues derived from this source and from the sale of certain privileges in the club-houses were placed in a fund. It was hoped originally that the clubs would become nearly if not quite self-sustaining, but this was not realized. The revenues were used to replenish worn-out and to purchase additional equipment, and to defray a portion of the remaining expenses, but they were far from adequate to meet all expenditures. The larger club-houses cost the commission during the great part of the period of canal construction about seven thousand a year each for maintenance, in addition to the original outlay.

The club-houses were only one feature, though a most valuable one, in the general policy of making life more attractive to the employes and of cultivating among them at the same time, a community spirit in support of public morality and good order. A no less valuable feature of this policy was the work of organized

religious bodies, and to this hearty co-operation and generous aid were given from the outset. Two-story buildings were provided in the chief labor centres, one story for use as a church and the other as a lodge or society room. All denominations were treated on equal terms. Resident and visiting chaplains were employed by the commission to hold services, to visit the sick in hospitals, and to perform other duties within their calling. In 1910 there were thirty-nine church buildings in the Canal Zone, twenty-six of which were owned by the commission, and all but two of which were on sites owned by the United States Government. Seven of these were Catholic, thirteen Episcopalian, five Baptist, two Wesleyan, one Seventh Day Adventist, eight non-denominationalist, including one Salvation Army. There were at that time in the pay of the commission fifteen chaplains, three Catholics, four Episcopal, four Baptist, two Methodist, one Wesleyan, and one Presbyterian.

Another feature of the commission's policy was encouragement to efforts on the part of employes to develop among themselves amusements and other means of recreation. When the employes organized a band of music from their own membership the commission hired a leader and voted to pay the players a small monthly stipend, expending in this manner about twelve thousand dollars a year. Through this aid a very creditable musical organization was built up which gave regular concerts on Sundays in the various villages of the Canal Zone. Baseball nines were encouraged by the creation of parks with suitable grounds

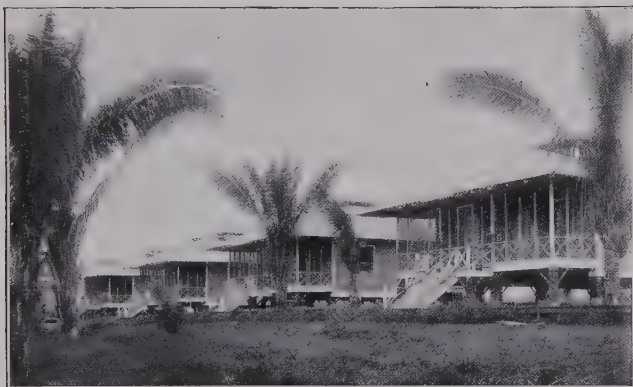
and other aid, and all forms of athletic sports received similar support. The formation of women's clubs was encouraged and assisted in like manner, and these became one of the most effective agencies of social intercourse and contentment that existed in the Canal Zone during the entire period of canal construction.

They were organized originally through the agency of Miss Helen Varick Boswell, who was employed for the purpose by the canal commission, on the authority of Secretary Taft. Government aid was used in this case, as it was in the construction of club-houses for the men in the canal service, for the purpose of affording necessary recreation and thereby inducing contentment and promoting efficiency. Miss Boswell went to the isthmus in September, 1907, and spent a month in visiting the various canal settlements and arousing interest among the women in the club idea. As a result nine clubs were formed in as many villages, and these in turn were assembled in a Canal Zone federation which was affiliated subsequently with the General Federation of Women's Clubs, an international organization extending throughout the United States, Great Britain, Canada, and other countries and comprising a membership exceeding a million. The Canal Zone clubs continued in active existence for six years, the federation being formally disbanded in April, 1913, because of the approaching completion of the canal.

It was estimated officially when the canal force was at its maximum that the cost to the commission of the various privileges or perquisites to employes, not



Four-family houses, two families upstairs and two down.



One-family houses,



Canal official's residence, at Ancon, Canal Zone.

Types of Canal quarters.

granted in similar employments in the United States, aggregated over two and a half million dollars a year; and that the average value of them to a married "gold," or American, employe was about seven hundred and fifty dollars a year; to a bachelor American employe, about four hundred and twenty-five dollars a year; to a married "silver," or alien, employe, about fifty dollars a year; and to a bachelor alien employe about thirty dollars a year.

Many persons, including members of Congress, who visited the isthmus during the latter half of the construction period regarded the expenditure for these various objects as excessive, and, in some degree at least, unwarranted. The same critics considered the granting of free quarters, fuel, light, and water, the payment of high wages, and the bestowal of other benefits upon employes as unnecessarily generous treatment. They saw everywhere among employes contentment, enthusiasm, pride in their work, and the resulting high efficiency, and being ignorant of original conditions on the isthmus, were unable to see that the end amply justified the means. The fact that with all the special privileges afforded, the annual change in the personnel of the canal "gold" force was at no time less than fifty per cent per year, furnished indubitable evidence that without them nothing like a permanent force could have been maintained. Through their use there was built up gradually a Canal Zone community, with its peculiar social activities and interests, and with no inconsiderable public spirit. It comprised about eight thousand white Americans, of

whom five thousand were employes and three thousand women and children. A more orderly community of like size could not be found anywhere. While the annual change was full fifty per cent a year, there was a permanent body of sufficient size to preserve a continuing public sentiment.

CHAPTER XIX

AUTOCRATIC POWER CONFERRED ON THE CHAIRMAN AND CHIEF ENGINEER — RULE OF THE “BENEVO- LENT DESPOT”

THE imperative necessity for single-handed, autocratic control of the entire enterprise was made apparent within a few weeks after the first canal commission came into office, in 1904. As stated in a previous chapter, it was an excellent body of seven men, but incapable of prompt and efficient action. The three-headed plan, described in Chapter VI, which President Roosevelt had authorized as the best available substitute, proved somewhat more efficient, but was still far from satisfactory, and the President had become convinced that a further concentration of power was desirable, and had made the chief engineer also chairman of the commission. Before entering upon his duties in this dual capacity, the chief engineer resigned, and President Roosevelt decided to make a complete change and put the work in the hands of United States army engineers.

The third commission, composed mainly of army engineers, entered upon its duties with the positions of chairman and chief engineer consolidated in one person. The executive committee of three had ceased to

exist, and rule by seven executives had virtually been restored. After a brief additional experience with this once rejected system, the President, who had reached the conclusion some time before that the only satisfactory solution was one-man control, took steps to secure it. On April 2, 1907, he issued an executive order decreeing that the "authority of the Governor or Chief Executive of the Canal Zone, under existing laws, resolutions and executive orders, shall be vested in and exercised by the Chairman of the Isthmian Canal Commission." On January 6, 1908, he issued another executive order which placed virtually supreme power in the hands of Colonel Goethals, making the other members of the commission, who were heads of departments and divisions, subordinate to him, and virtually abolishing the commission as an executive body. The process of evolution through practical experience had thus reached its logical and final stage, passing through various experimental stages of divided authority and responsibility to the concentration of all authority and responsibility in one person whose only superior officer was the President of the United States acting through the Secretary of War.

The period of highest achievement in canal construction dates from the issuance of this executive order. During the three years which followed, 1908, 1909, and 1910, nearly three-fifths of the entire amount of excavation needed for the canal was accomplished and the whole work was carried forward with such impetus that the canal's completion a year or more in advance of the date fixed for it was assured. The force was

knitted into a compact, harmonious, enthusiastic body, whose zeal, efficiency, and pride in the work commanded the wonder and admiration of all observers. When President Taft visited the isthmus in November, 1910, he was much impressed by it, saying on the eve of his return to Washington: "The first thing that strikes one is the fact that work is being done apparently on every foot of the fifty miles of the canal, and is being done under an organization of men, plants and material that operates as economically and effectively as if it were a machine with the hand of Colonel Goethals in control of the lever which sets and keeps the whole machine in operation."

As a matter of fact, the canal organization *was* a machine with the hand of Colonel Goethals on the controlling lever when the President saw it in operation in 1910, and it is so to-day—a huge, smoothly working engine of the highest capacity and efficiency. Its creation in the first place and its successful operation subsequently are both due to the possession of autocratic power by the man at the lever. Without that power he could not have set and kept the machine at "full speed ahead," with no fear of interference from any quarter, accomplishing results which in efficiency and economy are without parallel in great construction work either under private or governmental direction. That this is a conservative statement can be shown easily by a few citations from the record.

In October, 1908, the Isthmian Canal Commission made a carefully revised statement of the total excavation and cost of the canal. This action had been made

necessary by an advance in the cost of labor and in the prices of materials and manufactured articles, and by changes in the plan of the canal upon which the original estimates had been based, the most important of which were enlarging the size of the locks and widening the channel through Culebra Cut from 200 to 300 feet at bottom. This revised estimate placed the total amount of excavation at 174,666,595 cubic yards, and the total cost, including the \$40,000,000 purchase price to the French canal company, the \$10,000,000 to the Panama Republic for the Canal Zone, and loans to the Panama Railroad Company, authorized by Congress, exceeding \$8,000,000, at \$375,201,000. This estimate included an allowance for about 8,000,000 cubic yards of "slides" or "breaks" in the banks of the canal through the Culebra Cut.

Soon after this revision was made a great increase in the volume of slides and breaks began, lasting through several years and bringing the amount of material that had to be removed because of them to about 25,000,000 cubic yards. Because of these and of other developments as the work advanced, further revisions of excavation estimates were made in August, 1912, and in February, 1913, and the total required for the completion of the canal proper was placed at 218,138,724 cubic yards, or 33,472,129 more than the estimate upon which the final canal cost of \$375,201,000 had been calculated. Yet because of the efficiency and economy of operation which the one-man-power canal machine had attained, the commission will be able, even with this considerable lump of unanticipated

extra work thrown in, to complete its great task a full year or more ahead of time, and with several millions of its \$375,000,000 of authorized expenditure not needed and available for auxiliary work.

An elaborate system of cost-keeping, providing complete control over expenditures for labor, material, and supplies, and showing total unit costs for various parts of the work, which has been in operation since January 1, 1910, has been of great use in promoting economy.

Surely, if any form of government or control was ever justified by results that in force in the Canal Zone for the past five years has been. The great end sought was the construction of the canal in the shortest time, at the lowest price, and in the best manner possible. Precisely this accomplishment is assured. As the work has advanced, hostile criticism, which during the early years was abundant, often reckless, and not infrequently mendacious and malicious, has fallen gradually into total silence, and in its stead there is a world-wide chorus of praise. Not a shadow of scandal hovers over the task as the end approaches, nor is there audible the faintest whisper of "graft" in connection with it.

What is the proper definition of the form of government under which this triumph, which is bringing credit and honor to the American name throughout the world, has been achieved? Not "socialism," for there has been no suffrage in the Canal Zone, and suffrage is the foundation-stone of the socialist creed. Not "paternalism," for what the United States Government has been doing for the canal workers, its great army of peace, is nothing more than it does habitually for an

army of its soldiers either in the field or in military posts. The canal colony was merely a huge construction camp in a foreign land, doing a great piece of work for its employer, the United States Government, which, like other employers, must provide for all needs of its workers. No precedent is established by the acts of the government in this respect on the isthmus except for procedure in other government work under like conditions hereafter.

It was an autocratic government in the same sense that the direction of every great enterprise of similar character by private individuals or corporations is autocratic. In adopting the one-man-power system on the isthmus the United States Government did simply what is the practice in every great private engineering or construction project—select the right man for the head of it and give him absolute power to execute it without interference. No private enterprise, not even a peanut-stand on a street corner, could be conducted successfully with seven executives of equal powers, and very few any better with three. The United States Government tried both seven and three with most unsatisfactory results, and was fairly compelled to select one and give him virtually despotic powers. It depended upon the man whether his use of those powers should lead to success and national honor, or to failure and national disgrace, for it is upon the man and not upon the system that success or failure hinges in all cases. Happily, in the case of the canal the man was not wanting.

A few months after Colonel Goethals had entered

upon his duties President Roosevelt, who had been keeping a close and somewhat anxious watch upon the situation on the isthmus, wrote to a friend in a tone of visible relief: "Evidently Goethals is exactly the man for the work. How fortunate we have been to get him! I shall back him up on all points."

In order to "back him up on all points" the executive order of January, 1908, was issued, and under that Colonel Goethals became the supreme ruler of the Canal Zone, creating that unique form of government which is best described as "benevolent despotism," or "rule by a benevolent despot," which Carlyle declared to be the ideal form of government provided an able and just man be secured as despot. That the Canal Zone has had such a despot for five years, a despot who has not abused his great powers but has used them with justice and wisdom, is the unanimous and enthusiastic verdict of the great body of his subjects. No ruler anywhere has ever had under him a more loyal, devoted, and contented people than Colonel Goethals has had during his leadership and will have to the end. They have unbounded faith in his ability as an engineer and like faith in his ability and justice as a ruler. "He's onto his job and he's square," is the terse way in which the average canal worker puts it; and when you come to think of it, that is not a bad definition of a benevolent despot.

My official relations with Colonel Goethals make indecorous any close analysis of his character and personal attributes, but I may be permitted to quote the estimate of a keen observer who has had wide experi-

ence in the study of affairs and men, and who, whatever else may be said of him, has never been accused of too great leniency in judgment or a tendency to overpraise. Mr. Charles Francis Adams, of Boston, who visited the isthmus in 1911 and made a careful study of the canal work, said in a paper read after his return before the Massachusetts Historical Society, of which he is president:

In the course of a fairly long and somewhat varied life it has been my fortune to be brought in contact with many men—men prominent politically, and in administrative and professional work; generals in command of armies in active warfare; executives in the direction of large enterprises; financiers; notables of the market-place. The one thing in these contacts which has always insensibly but most impressed me has been the presence or absence in individuals of that element known as Character. Whether there or not there, the sense of its being there, or not being there, is instinctive. If there, in the man at the head, the thing permeates. You are conscious of it in every part. The individuality and character of Colonel Goethals to-day permeate, and permeate visibly, the entire Zone;—unconsciously on his part, unconsciously on the part of others, his influence is pervasive. Nor, in expressing this opinion of Colonel Goethals, do I for a moment wish to depreciate, much less to ignore, the zeal and fidelity shown by the heads of departments in the present Canal organization. One and all, so far as my brief stay afforded me opportunities of reaching an opinion, were stamped by the same die. Of some, of course, I saw but little; others I did not meet at all; but indications of the influence of Goethals were, I thought, perceptible everywhere. Quiet, reserved,

unassuming, known to every one engaged on the work, but noticed, as he quietly moved around, by no one, he gave the impression of conscious because innate but unobtrusive force.

It is an interesting and suggestive fact that the man who has won victory for his country in the greatest campaign ever conducted in the interest of world-wide peace and progress should have been trained by the government to serve his country as a soldier in time of war.

In conferring upon him the honorary degree of LL.D. in June, 1912, President Lowell, of Harvard University, said:

George Washington Goethals, a soldier who has set a standard for the conduct of civic works; an administrator who has maintained security and order among a multitude of workmen in the tropics; an engineer who is completing the vast design of uniting two oceans through a peak in Darien.

CHAPTER XX

A SQUARE DEAL FOR ALL — AN OPEN DOOR FOR ALL COMPLAINTS — GOOD EFFECTS OF THE POLICY — A NOVEL COURT OF JUSTICE

NOTHING contributed more powerfully to the efficiency of the canal force than the policy adopted by Colonel Goethals toward complaints of all kinds. Under the preceding administration the policy pursued had been that generally enforced by railway and many other large employers of labor in the United States, namely, to pay as little heed to complaints as possible and get rid of the complainants. The head of the Department of Labor and Quarters was a railway man of wide and varied experience. It became the established practice during his administration to greet all complainants with the formula: "You don't like it here? Well, then, get off the isthmus! There's a steamer every five days." The effect of this policy was to create throughout the force a feeling of surly discontent and resentment, which did not make for efficiency, and which grew stronger with every additional rebuff.

When the Goethals administration came in, a great flood of complaints about existing conditions poured in upon it, so great that special measures had to be taken to dispose of it. The secretary of the commission

was directed to investigate fully all complaints and give an absolutely "square deal" to all complainants, reporting to the chairman for final action. Official notice was sent out and posted in all the labor camps and mess-houses, informing employes that they would be given a fair hearing on all grievances and telling them where to present them.

When this policy was announced the head of the Labor Ddepartment, who had been retained from the preceding administration, went to the secretary and protested vigorously against it, saying that as an experienced employer of labor he knew it to be a most disastrous policy to pursue; that it would encourage complaints rather than diminish their number, destroy authority and discipline, and make the employes masters of the situation. Similar advice was given by other prominent members of the previous administration and the same direful results were predicted.

These gloomy prognostications were destined never to be realized. On the contrary, the new policy, put into operation with good faith and thoroughness in all parts of the work, accomplished results which justified fully its practical wisdom as an agency of efficiency. All complaints by American employes, who were composed mainly of clerks, nurses in the hospitals, foremen and mechanics, there being no American common laborers, were investigated by the secretary of the commission. A special assistant, detailed by the chairman of the commission for that service because of his familiarity with foreign languages, investigated all complaints by the Spanish, Italian, and other European

laborers and reported the results to the secretary. These complaints were in the main due to language misunderstandings and called for no elaborate inquiries. It is an interesting fact that the special assistant who performed this service for several years, and performed it with signal ability and unvarying fairness, was Giuseppe Garibaldi, a grandson of the Italian liberator, who figured later as a revolutionary leader in disturbances on the Mexican border in 1912.

In regard to the complaints of American employes the method pursued was to send for the complainant and ask him to make a full statement to be taken down by a stenographer, the same to be used as a basis for inquiry. In a majority of instances, the complainant before this proceeding was completed, concluded, after asking to have one point after another stricken from the record, that he had no grievance after all and preferred to drop the matter. The mere process of talking freely about it had been all the relief he needed. He had "got it out of his system," where it had been seething for an indefinite period simply because he had been denied a hearing.

Whenever the complainant completed his statement and requested investigation it was accorded him. All persons involved were sent for and statements were obtained from them. Finally, complainant and accused were brought together in a conference, and a decision was reached which, in nearly every instance, was accepted by all parties.

For fully six months the time of the secretary was taken up almost entirely with this work. During that

time several hundred complaints were disposed of, and in only one instance did a complainant fail to express himself as satisfied with the verdict. He had complained of unjust discharge, but had been shown to be incompetent. When the decision against him was made he boasted of "powerful political support" by a United States senator and declared that he would go home and "raise hell." If he raised it, no news of the disturbance reached the isthmus.

The American complaints included unjust discharge, refusal of or failure to get promotion, harsh treatment, poor mess-house food, false charge of disorderly conduct in mess-houses, belief in existence of conspiracy to injure, denial of sick or injury leave with pay, refusal of transfer, and other phases of alleged ill treatment. In all cases in which the complaint was sustained by the evidence the proper remedy was decreed and accorded, to the expressed satisfaction of all parties.

In many cases the complainant confessed judgment by failing to appear after the first conference and leaving the isthmus before the inquiry was completed. Usually in such cases the grievance had been unjust discharge, and the evidence was overwhelmingly against the complainant, who was shown to be a poor workman and an habitual trouble-maker of whom the service was well rid.

The services required of the special assistant among the Europeans, mainly Spanish laborers, were varied and interesting. They comprised chiefly food, treatment, troubles with the police courts, misunderstand-

ings about pay, and mistakes in regard to postal money-orders. Through the complaints about food the commission was able to ascertain the special needs of the European laborers in this regard, and by supplying it to promote contentment and thereby increase efficiency. Through complaints of ill treatment by foremen or bosses, usually the result of language misunderstandings, useful knowledge was obtained as to the special qualities required for an effective foreman, and also of the individual fitness of the foremen in command, which was of great value in getting the best labor results. The chief value, however, of this special service was to convince the laborers that they could get a hearing for their grievances at all times, that they had a friend, supplied by their employers, to whom they could go for counsel and help in all emergencies, and who would obtain justice and fair treatment in every instance. In short, they were treated like human beings, not like brutes, and they responded by giving the best service within their power. So important did the chairman and chief engineer consider this special agency to be in getting the best work from the European laborers that he continued it in connection with the secretary's office till the end of construction.

The practical wisdom of the "square deal" policy was demonstrated clearly during the first six months of its operation. At the end of that period complaints, which had been diminishing steadily in numbers, ceased almost entirely. Those that came in were for the most part trivial in character and called for no

serious investigation. In the few cases in which they were serious enough to require formal inquiry the chairman either directed one to be conducted by the secretary or by a board especially constituted for the task. The custom of going to the chairman personally with complaints because of his known willingness to listen to them grew up gradually, till he gave up each Sunday morning to receiving in his office at Culebra any and all persons who had grievances. He sat there from 7.30 till noon, in a court which has had no parallel in American or any other modern history. Its doors were wide open to all comers, from the highest to the lowest degree in the canal service. He was a combination of father confessor and Day of Judgment, whose like has rarely if ever been seen since the time of Solomon. "If you decide against me, Colonel," said a complainant, "I shall appeal." "To whom?" asked the Colonel, and there was no answer, for there was none to make. The man on the bench was the whole court, full bench and chief justice, and there was no court of appeals above him. That he was a just judge the absolute and united faith of the canal force in him is sufficient proof.

From time to time there appeared in the Canal Zone representatives of various organizations professionally devoted to the welfare of the laboring man, but innocent of all practical knowledge of labor itself, who were eager to tell the canal commission how to care for its workers. They have in most instances been excellent samples of that class once characterized by ex-President Roosevelt as made up of the "old maids of

both sexes." They have failed invariably to perceive a fact plainly apparent to all other observers, that the Canal Zone, under the generous care of the United States Government and the autocratic rule of Colonel Goethals, was the paradise of the working-man, and have proceeded to instruct the Colonel in the way he and the canal commission should go in regard to the welfare and happiness of employes. One of these recommended the establishment of small pleasure resorts, miniature Coney Islands, at various points across the isthmus, with a trolley-line connection, and hot baths for the frail laborers who could not stand water at the temperature of seventy-nine degrees, which is the mean temperature of the isthmus. Another, in order to relieve the canal officials of burdens of which they had made no complaint, suggested the appointment of a labor commissioner, at a handsome salary, to have charge of all questions, including complaints, salaries, and hours of work, that might arise in the canal force. He admitted that under the existing system every worker could obtain a hearing and review of his case, and that in consequence of this policy the force was permeated with a spirit of good-will and loyalty that was most impressive, but he thought Colonel Goethals should be relieved of the burden of hearing complaints personally. Colonel Goethals was unable to take this view, saying that, while much of his time was consumed in such hearing, the advantages accruing more than offset the time spent, since he was kept thereby more closely in touch with the men, learned more fully the relative merits of the various

subofficials, and at the same time acquired a more intimate knowledge of the details of the work itself. "Every employe," he said, "irrespective of race or color, now understands that, if his superior does not correct any abuses reported to him, or if he cannot get satisfaction for any actual or alleged grievances, the chairman of the commission and its secretary are at all times accessible and that a prompt investigation is invariably made. I do not know of an employe who has not felt that full and ample justice has been meted out to him by all investigations conducted by the secretary of the commission."

The free accessibility of every worker to the chairman not only gave him a knowledge of the relative merits of the various subofficials and of their conduct, but the assurance of such accessibility in all cases of dissatisfaction made those officials very careful about giving cause for complaint. Every foreman and gang-boss knew that if he mistreated his men, oppressed them, endeavored, as sometimes happened, to practise some form of tribute or extortion, knowledge of his conduct would reach the chairman and he would be out of a job immediately, for there was no mercy at headquarters for such offenders. This being the case, great care was exercised not to give provocation for complaint, and the men were in that condition of contentment which is the first essential of the highest efficiency, for a surly and dissatisfied body of workers will never do their best for a foreman whom they dislike because of unjust or brutal treatment.

The proof of the pudding is in the eating. No body

of laborers anywhere at any time has developed a degree of efficiency superior to that obtained by the canal workers, and very few a degree equalling it. In no other body of laborers was there ever found more loyal devotion to the leader, or greater individual pride in the task, or a more general spirit of cheerfulness and contentment. These characteristics impressed all visitors to the canal work while it was in progress, who commented upon them as remarkable and almost if not entirely without parallel. They commented also upon the alertness and activity of the force, noting the absence of idleness everywhere and the complete lack of grumblers and "kickers." The policy of open court and square deal had weeded the last named from the force, and this was not the least of its beneficial effects.

Large employers of labor everywhere will find in the results thus achieved in the canal force of forty thousand men, made up of many and widely varying nationalities, much material for study. There have been no strikes worth mentioning in the Canal Zone, and no difficulties requiring outside boards of arbitration to settle. There has been despotic control by a single man who was able to make it both popular and effective to a marvellous degree because, through personal contact and free intercourse with all members of his force, he had exact and full knowledge of every phase of the work and of the qualifications and conduct of every one of his subordinates engaged in its direction.

CHAPTER XXI

CANAL LABORERS — DIFFERENT NATIONALITIES EMPLOYED — CHARACTERISTICS AND EFFICIENCY — EFFECTS OF CLIMATE AND OF CIVILIZATION

WHEN the Americans began work on the isthmus they found a force of laborers that had been kept together by the French company, which, together with the force of the Panama Railroad, numbered about seven hundred men, all West Indians. No other kind of labor was available. Mr. Wallace and his associates had arrived on the isthmus determined to begin work at once in order to comply with the demand of the American press that they "make the dirt fly." In seeking to do this they retained the existing force and endeavored to increase it. The consequence was that the demand for labor exceeded the supply, and the West Indians were convinced that the canal could not be built save through their aid. Their natural vanity and high sense of self-importance were greatly enhanced by this belief. Indifferent laborers at best, they became independent and careless, and worked only enough to obtain money for their daily needs, which were few and very inexpensive. The idea of working to save for the future or to provide for their families in old age, had never been known to the race. They obeyed strictly the mandate

of the Scriptures, to "take no thought for the morrow," knowing from lifelong experience that the morrow would take care of them. They had few unsatisfied wants, and consequently lived in contentment. They wore very little clothing and that of the cheapest quality, while their children wore none at all till they reached six or eight years of age. The jungle was fruitful with bananas all the year round, and yams and like food grew in the ground abundantly with very little cultivation. Meat they ate scarcely at all, caring very little for it. One day's work a week, at most two, would be ample to supply bodily necessities, and the result was that while ten thousand names might be on the pay-rolls, not more than half that number might be at work regularly. They were very "cocky" about being rebuked or hurried, and if a foreman spoke to them harshly would draw themselves up with amusing dignity and say: "You can't address me in that manner, sah! I am a British object!"

Mr. Stevens, the second chief engineer, had a very poor idea of their value or usefulness as laborers, reckoning their efficiency at about a third of that of a white man. Their tendency to illness contributed to his low estimate. He said of them in 1906: "Any white man, so-called, under the same conditions will stand the climate on the isthmus very much better than the blacks, who are supposed to be immune from practically everything, but who, as a matter of fact, are subject to almost everything." He was convinced that the canal could never be built with West Indian labor alone, and early in his year of service he sent an em-



Arrival of 1,500 laborers from Barbados at Cristobal on S. S. *Ancon*,
September 2, 1909.

ployment agent to northwestern Spain to secure from that region a supply of laborers. He was moved to this action because laborers from that region who had been employed on railway construction in Cuba and had gone from there to the isthmus had proved to be very satisfactory. To induce them to go to the isthmus, the agent advanced their passage-money, to be deducted gradually afterward from their pay, promised them free quarters and other privileges, employment as long as the canal work should last, and twenty cents gold an hour in wages, which was double the wage paid to the negro laborers.

During the first six months of 1906 about 900 Spanish laborers were procured, and by the end of that year there were about 1,200 at work. They were a hearty, vigorous body of men, trained to severe and continuous labor, and accustomed to meagre wages and frugal living. They proved to be so satisfactory that during the succeeding two years, 1907 and 1908, about 7,000 more were secured, bringing the total taken to the isthmus under contract to 8,222. During the same period, 1906-7-8, there were also taken to the isthmus, under similar contract obligations, about 2,000 Italians, 1,100 Greeks, 30,000 West Indians, 1,500 Colombians, and comparatively small numbers of Armenians and French, bringing the total number of contract laborers secured during the period of active construction up to nearly 45,000. Of this number, 11,797 were Europeans, and in recruiting and transporting them there was spent \$508,770.83, of which all except about \$100,000 was collected from wages,

making the per-capita cost to the canal commission \$8.46. After 1908 no recruiting was necessary from Spain and other European countries, and no contracts were made, because the favorable reports of high wages and good treatment which the contract laborers sent home started a voluntary immigration to the isthmus which furnished an abundant supply of labor.

At the outset the Spanish laborers justified the anticipations of Mr. Stevens in showing an efficiency about double that of the West Indians, but as time went on this diminished, while the efficiency of the negroes increased. Several causes contributed to these results. The Spaniards worked continuously without vacations, and after five years of this unbroken labor in the tropics they experienced a loss of physical vigor and energy which affected their work. Then, too, close association with a less vigorous and less industrious class of laborers had the natural effect of reducing their activity. On the other hand, the West Indians, under the influence of competition and the driving energy of American foremen, and safe from the deterioration of physical force which a tropical climate was causing to the Spaniards, increased steadily in efficiency, so that at the close of the construction period the two classes of labor were reckoned to be approximately equal in usefulness. One had deteriorated and the other had improved, but neither was at the high level held by the Spanish at the beginning of the work.

The Europeans were engaged almost entirely in unskilled labor. They were quick to learn team-work in gang operations, dumping cars, moving tracks, and

labor of that sort which afforded little opportunity for development. Some of them were employed as firemen, others did mechanical work in the shops, and these showed considerable capacity; but they were handicapped by knowing no English, all superintendents, foremen, etc., being Americans.

Among the West Indians were many experienced artisans who had worked at various trades before going to the isthmus, and between 4,000 and 5,000 of these were so employed during the busiest years of work and proved to be very satisfactory. Great numbers of others were employed as mechanics' helpers, in work about wharves and docks, as waiters and servants in hotels, in general work in hospitals and offices, and in domestic service. They were a quiet, generally honest, soft-spoken and respectful body, as a rule, but slow both in mental processes and physical movement. They showed aptitude in learning essentials in the various branches of work in which they were engaged, and acquired a kind of automatic regularity in the performance of duties. A few developed some initiative and some originality in certain trades, but for the most part they had not even a glimmer of anything of the sort. What they had always done they were content to go on doing in the same way, and neither desired nor could be induced to change it.

The great bulk of them preferred to live in Panama and Colon, or in their native villages, or in huts or shacks in the brush or jungle, rather than in the quarters which the commission offered them free of rent, and preferred the simple food to which they were

accustomed to the more nourishing diet which the commission tried in various ways to induce them to eat. They were offered first cooked food of excellent quality at ten cents a meal, and the uncooked ingredients of the meals at lower rates, but they would not accept either. Then, as an experiment, they were offered uncooked food free, but they did not care enough for it to cook it. Then they were offered cooked food free, and this they ate heartily. The experiment was next made to give them a fixed wage and include in it three meals a day, to be eaten or not as they chose. It succeeded for a time, but was abandoned as not practicable.

The object of all these experiments was the same: to improve their physical condition and thus increase their efficiency. By the same process of evolution through which all other departments of canal commission activity had arrived at the most satisfactory basis of operation, there was adopted a method of feeding which was partially successful. Kitchens were established near the main negro camps at which a ration of three cooked meals a day was served for twenty-seven cents a ration. There were seventeen of these in as many places and they were patronized by from 1,200 to 1,500 of the 30,000 or 35,000 West Indians in the commission and Panama Railroad service. Special efforts were made to supply them with the articles of diet which they preferred. But even with this attraction and the excellent quality of the ration, the great majority preferred to eat elsewhere. They could buy such provisions as they liked at the commission



White Canal laborers.

Upper group: Gallegos.

Lower group: Italians.

commissaries along the line and cook them in their shacks or in messes of their own. This method suited them best of all.

It was much the same with living quarters as with food. The great majority of the negroes preferred a shack in the jungle to the clean and airy quarters which the commission offered free. The movement to the "bush" was a steadily increasing one, and during the final years of work not more than a fifth could be persuaded to live in the quarters. The others lived either in the cities of Panama or Colon, or in native villages near the American settlements, or in shacks scattered on the hillsides. This was due mainly to a desire for greater freedom of conduct and partly to the fact that the commission did not furnish quarters for married negroes. In 1908 an order was issued requiring that every applicant for sleeping quarters should show a kitchen meal ticket. It was thought that this would have the effect of inducing more of them to eat the kitchen food. It had precisely the opposite effect, driving several hundreds entirely away from both the kitchens and quarters to the native villages and the jungle hillsides.

An interesting sociological phase of the canal work is the effect which contact with American civilization and ways of living has had upon the ideas and habits of the West Indians. When the Americans began work the average native of the isthmus and the adjoining islands was in that ideal state of contentment which comes from the absence of unsatisfied desires. As I have said, he had no wants that he could not meet

easily, no aspirations for a larger or more enjoyable life than the one he was living, and a capacity for rest that was unlimited and inexhaustible. As time went on, however, an insidious development of discontent began within his household because of changing conditions and surroundings. He was compelled, in obedience to the behests of a more advanced civilization, to put clothing upon his infants. This entailed slight expense at first, but a steadily increasing one. A single nondescript garment with very limited concealing capacity served for a while; but it was soon replaced, in obedience to maternal pride and feminine love of ribbons and finery, by far more adequate and costly apparel. One by one the little black and brown cupids, or, as a distinguished American lady visitor to Panama called them, "chocolate drops," disappeared from public view, and in their stead came the thoroughly garbed infants of civilization, their little toes incased in pink and red and white shoes, their little bodies covered with fluffy white gowns and their bright little faces peering from beribboned caps. It was a wonderful transformation, but a distinct loss in primitive picturesqueness, and compelled a decided increase in the parental earnings and expenditure.

Then, too, the women of the household began to make larger demands. One calico dress, which had satisfied all yearnings in the past, provided the colors were sufficiently vivid, would no longer suffice. A real lady's hat, with ribbons and other embellishments, must be procured in place of the battered old straw or felt that had hitherto been worn. In order to satisfy

these new desires, the head of the household must change his working habits. One or two days a week would suffice no longer. He must get and retain regular employment and thus become a steady earner and larger provider for his family.

It came about, therefore, that by introducing discontent into the daily life of the West Indian, the American canal builders made him a better laborer and a more useful member of society. White dwellers in those West Indian islands to which natives have returned after working on the canal say that they exhibit a marked increase in capacity. Whether the improvement will be permanent or not remains to be seen, but that it was made through injection into their lives of new and unsatisfied desires, with the consequent discontent, is the unquestionable fact upon which the sociologists of the world may concentrate their minds.

CHAPTER XXII

LIFE IN THE CANAL COLONY — ITS ATTRACTIONS, DIS- TRACTIONS, PECULIARITIES, AND SPECIAL CHARM

“Do you like it down there?” That question, asked most often with an inflection of tone which implied a conviction that no civilized being *could* like life in such a place, was very familiar to all persons connected with the canal work who were in the United States on annual leave of absence during the period of construction. It was asked invariably by some one who had never visited the isthmus. Visitors after a few days’ sojourn, especially if they belonged to what, in days that are no more, was known as the “gentler sex,” seldom or never asked it, or, if they asked it, did so in a quite different tone. They were most apt to say: “I think it the most delightful place I was ever in. I would like to stay here indefinitely.”

That the isthmus, or that portion of it occupied by the canal colony, was a delightful place of sojourn, for a limited period, none of its inhabitants will deny. (I use the past tense, for soon after these lines appear in print the habitations of the colony will have been demolished, and their occupants will have been scattered to other parts of the earth.) It was delightful in the first place because, during the three months of the dry

season, the period in which visitors from the outside world arrived, the weather and temperature were nearly or quite all that could be desired. Every day was a perfect copy of its predecessor and the exact promise of what its successor would be. The scorching rays of the tropic sun were tempered by a refreshing wind and any place in the shade was cool and enjoyable. With the decline of the sun came an evening and night with a temperature that can only be described properly as delicious. It would be difficult to find anywhere on earth a spot where the evenings and nights are more delightful than they are at Panama. The temperature varies scarcely at all the year round. The mean is seventy-nine degrees, the thermometer ranging from ninety-six in the middle of the day to sixty-five in the evening and night. A hot night, in which comfortable sleep is not possible, is a very rare occurrence.

It is the monotony of the climate that wears upon the nerves and temper, but the visitor does not remain long enough to feel this. Toward the end of the dry season, when the land is parched and barren and all freshness of the very atmosphere itself is burnt out, the strain of monotony becomes almost unbearable, and the peace of more than one household as well as that of the community is threatened by the ravages of a general epidemic of raw nerves. The wet season has drawbacks of its own, the chief of which is a prevailing dampness that moulds and rots clothing and makes drying-rooms a necessity. But the rainy season does not bring rain every day, nor prolonged storms like the northeasters of the temperate zone. There are

very few days in which there is no sun, and very few in which there is continuous rain. There are heavy downpours in showers, usually between noon and four o'clock in the afternoon, but the mornings and evenings are usually clear and the country is always fresh and brilliant in its tropical garb of vivid green. Most regular dwellers in the Canal Zone prefer the rainy season to the dry, but its partially unmerited reputation for excessive rain and discomfort prevents outsiders from obtaining personal knowledge of it.

Life in the canal colony was agreeable and in the main joyous, but it should not be accepted as a fair test of the ability of Americans or rather inhabitants of the temperate zone to find life in the tropics permanently comfortable and satisfying. The canal colony had all its wants met without stint by the government of the United States. Artemus Ward, in his inimitable interview with Queen Victoria, asked her if Albert Edward was a "good provider." No visitor to the isthmus needed to ask that question about the United States Government after inspecting the quarters and general provisions for the comfort of its employes in the canal service. From the highest official to the common laborer, all were housed and cared for as no body of workers was ever cared for before. The houses, made of pine boards painted or stained, were models of convenience and comfort. As time went on and their occupants had changed them from mere houses into homes, covering them with climbing vines and surrounding them, through government control and aid, with flowering shrubs, they acquired an amount of

artistic beauty and charm which commanded the admiration of tourists and gave to the villages, in spite of the temporary character of the buildings, the attractive aspect of permanent abodes. The wide screened verandahs were converted into nature's greenhouses with flowering plants and spoil from the jungle—ferns, palms, and orchids. Behind these barriers of grateful foliage and bloom the occupants lived and slept virtually in the open air, for windows were seldom closed and the screens were a safe protection against insect pests. Many of the houses, notably those of two commissioners at Culebra, became through the zeal and taste of their mistresses, Mrs. Gaillard and Mrs. Rousseau, veritable gardens of beauty—miniature representatives of the jungle—with a wealth of rare orchids and ferns which made them the showplaces of the isthmus.

But an influence far more powerful than agreeable living was behind the contentment of the canal colony, and that was the indefinable charm of participation in a great work. The canal was not merely a great work, but the greatest of its kind in all the ages. It was, furthermore, an American work, carried on by the nation, with the eyes of the civilized world upon it, and success would bring honor not only to the nation but to all who had helped to secure it. Realization of all this, however slight it may have been at the outset, developed quickly into an enthusiastic national pride so controlling and absorbing that discomforts of all kinds were disregarded.

Then, too, as construction advanced and the colossal

proportions of the task began to be apparent, every one connected with it fell under the spell which Joseph Pennell calls the Wonder of Work. Pennell himself, when he visited the canal work in 1912, not only fell under the spell but was so thoroughly mastered and possessed by it that he was able to transmit it to paper and give to the world that incomparable and immortal series of drawings in which it stands revealed to the eye. Many of those engaged in the work had felt the sublimity and majesty of the spirit which hovered over it; had seen it in imagination as they walked through Culebra Cut or stood within the towering walls of the locks; many others had felt its influence unconsciously, not knowing what was stirring the souls within them; but Pennell, with the clear and inspired vision of the great artist, felt it, saw it, and with his trained and sure pencil traced its outlines for all the world to see.

He not only interpreted for the American canal workers the charm which they felt, but he made known to their own countrymen and to the world the true proportions of the task they were performing. They had found pleasing to the eye the arches and buttresses of the approach walls of the locks, he declared that these had "splendid springing lines" and were "as fine as the flying buttresses of a cathedral," and when they looked upon them in his drawings they knew that he was right. "I went to see and draw the canal," he says in the preface to the bound volume of his pictures, "and from my point of view it is the most wonderful thing in the world; and I have tried to ex-

press this in my drawings at the moment before it was opened, for when it is opened, and the water turned in, half the amazing masses of masonry will be beneath the waters on one side and filled with earth on the other and the picturesqueness will have vanished. I saw it at the right time and have tried to show what I saw. And it is American—the work of my countrymen.”¹ In another place he said of his drawings: “They are a record of subjects which even now exist no longer, but which in my lithographs, I hope, may, to the best of my ability, be preserved—a memory of the greatest work of modern time—a record of the greatest American achievement of all time.” That the drawings will be preserved for all time is an assured fact, for full sets of them have been purchased by the Isthmian Canal Commission and the principal museums and art galleries of the United States and Europe.²

Pride and joy in the work constituted the magic bond which held the canal colony together and made its members content to remain on the isthmus. If any one had doubts on this point, he had only to ask a member if he expected to remain after the canal was completed. The answer was the same invariably: “Oh, no! I want to stay here till the work is completed, want to go through the canal on the first ship, and

¹ Joseph Pennell's "Pictures of the Panama Canal," J. B. Lippincott & Co., Philadelphia, 1912.

² Library of Congress, Washington; the Isthmian Canal Commission; the Pennsylvania Academy of Fine Arts; the St. Louis Museum of Fine Arts; the Brooklyn Museum of Art; the Chicago Art Institute; the Italian Government for the Uffizzi Gallery, Florence; the British Government for the Victoria and Albert Museum, London; the British Museum, London; the Birmingham Museum, England.

then I cannot get away too soon." Life on the isthmus, without the absorbing and inspiring canal work, was looked upon by the overwhelming majority of Americans engaged in it as intolerable. There were some who had found the life so agreeable, so suited to their tastes, temperament, and physical conditions, that they wished to remain permanently; but these were comparatively few in number and belonged mainly to the laboring classes.

Yet the canal colony had been a reasonably happy and contented community. To say more than that would be to say that it did not contain the normal allotment of human nature. Careful and prolonged observation justifies the assertion that the regular supply was fully up to the average, at times reaching proportions which led thoughtful persons to suspect that a shortage must exist in other localities.

It was something more than a canal colony, for it included the diplomatic representatives of the United States and many other countries—Central and South American and European. These widened the colony's social horizon and brought into its activities and pleasures a cosmopolitan variety and interest which added perceptibly to their attractiveness.

The relations between the two "sets" were quite uniformly harmonious, the only exceptions being rare manifestations of individual temperament more amusing than serious. Especially close and unvaryingly friendly was the association with the representatives of Great Britain, headed by Sir Claude Coventry Mallet, for thirty years stationed at Panama, as consul,



Sir Claude Coventry Mallet.



Lady Mallet.

consul-general, and minister resident. His long and continuous service made the British legation the one fixed and stable point in an otherwise constantly changing diplomatic world. The envoys of other nations, notably those of the United States, came and went with fairly bewildering rapidity, but the envoy of Great Britain remained at his post as solid and unchanging as the empire of which he was so worthy a representative.

But there were other qualities than permanency which gave the British legation its undisputed leadership and its peculiar attractiveness to the Americans of the canal colony. The chief of these was the cordial and hearty fellowship which from the beginning to the end of canal work existed between Sir Claude and the commission. This was of incalculable value because the great mass of West Indian laborers were British subjects—or, as they always style themselves, “British objects”—and there were constantly arising questions in dispute which had to be settled between the British minister and the commission. Each party to this settlement acted invariably on the assumption that the other had in view only what was just and right, and the result was a complete absence of friction, with speedy and mutually satisfactory adjustment in all cases. Combined with this official fellowship was a social fellowship, no less complete and hearty, with Lady Mallet fairly challenging her husband’s title to supreme popularity. No one else on the isthmus did more to banish the always impending plague of monotony than these two did, and the American members of

the canal colony will hold them in grateful and lasting remembrance.

The last traces of monotony passed away as the canal work advanced and the fame of its wonders spread through the world, bringing visitors from every land under the sun. From the United States they came in hordes of hundreds, all filled with enthusiastic pride in the work and exuberant in praise of the workers. Visitors from other lands, fewer in numbers, while less vociferous in their admiration, were neither stingy nor backward in expressing it. A seasoned Scotchman who had inspected the work amid a throng of Americans and whom the persistent screaming of the eagle had visibly annoyed, was moved to say: "You Americans have at last done something worth bragging about!"

This chorus of praise fell gratefully upon ears that had heard less agreeable music in earlier days, and its effect was naturally to increase the general contentment. Then, too, among the visiting throngs there were men and women of light and leading in all lands, of the kind whose acquaintance is one of the supreme joys of existence—artists, writers, scholars, educators, soldiers, judges, lawyers, who brought with them glimpses of the best that the world has to give. They imparted to the social life of the canal, during its later years, an intellectual delight that will be among the pleasantest memories of its members.

And there will be no lack of pleasant memories. The colony was in many respects unique in American experience. It had some of the elements of a military

post, but its general character was more diversified and democratic because of the presence of many civilians. The disturbing rule of precedence held slight and uncertain sway, seldom ruffling the calm surface of good-fellowship which close association in a common and inspiring cause naturally engendered. Life in it had all the characteristics of life in a small community everywhere, but it was a life in the open air the year round and under conditions which eliminated many discomforts and annoyances usually to be found in such communities.

That it was an enjoyable life on the whole was realized with somewhat unanticipated keenness when the time for separation arrived. Although the desire to get away now that the task was done was general and strong, few were able to part forever from the land, to which many of them had gone a few years before with reluctance and even fear, without casting one "long, ling'ring look behind."

CHAPTER XXIII

THE NEW PANAMA RAILROAD

AFTER a full half-century of existence, during which it had rendered to the progress of the world a service immeasurably greater than any dreamed of by the most imaginative of its indomitable builders, the original Panama Railroad was abandoned to make way for the canal in whose construction it had been the chief instrument. Its rails were torn up and its roadway for the greater part of its length disappeared forever beneath the waters of Gatun Lake.

At the time of its abandonment very little of the original road except the alignment remained. When the American canal-builders arrived on the isthmus they found as the transportation agency of the great task before them a railway that in every important respect was a quarter of a century behind the times. Its rails were too light to sustain the weight of modern locomotives and spoil cars, its culverts and bridges were in the same condition, and it had only a single track. They began at once to convert it into a double-track system, with heavy modern rails, to strengthen or rebuild its bridges and culverts, to equip it with modern locomotives and cars, and to supply it with an up-to-date personnel.

When the road was taken over, in 1904, it had about 47 miles of a single track and 26 miles of siding, with a rolling-stock that was virtually worthless. Five years later the total trackage was 160 miles: 50 miles of main track, 35 miles of double track, all relaid with 90-pound rails; the equipment, thoroughly modern, comprised 150 locomotives, 1,500 freight cars, 50 passenger cars, and 4,000 spoil cars. Over the main track there passed daily 574 trains, including 160 trains of spoil cars. The number of passengers carried in 1910 exceeded two and a quarter millions, the amount of commercial freight exceeded one and a quarter million tons, and the amount of excavation spoil over its various tracks was nearly or quite 40,000,000 tons. It was indisputably the busiest railway, large or small, in the world.

Fifty-two years after the original Panama Railroad had been opened to traffic the construction of the new one was begun. The surveys were made in 1906 and in June of the following year work was begun.

The situation was in striking contrast with that which had confronted the builders of the original road. Those brave pioneers had begun their task in a pest-ridden and barren wilderness through which they must cut their way foot by foot. They had only hand implements with which to work, no land habitations save rude huts in swamps and jungles, no food supply which would be considered tolerable in these times, for cold storage was unknown, and no accurate medical knowledge with which to counteract and overcome tropical diseases. The only road that it was possible for them to build was along the lines of least resistance,

that is, through the river valleys, where the natural obstacles were the least formidable. They worked waist-deep in the slimy water of swamp and morass, piling up slowly the low embankments upon which to place their road-bed, and compelled to abandon all progress from time to time because of sickness which incapacitated the entire force. The labor which they were able to command was of the poorest and most ignorant quality, for the curse of pestilence was upon the land and intelligent laborers could not be induced to enter it.

A half-century later what a marvellous transformation had been wrought! The isthmus had become a land of health and plenty. The progress in mechanical invention and in the science of engineering had been so great that such a thing as an insurmountable natural obstacle to railway construction no longer existed. There was assembled on the isthmus, for the construction of the canal, a mechanical equipment which embodied all the latest and most efficient results of scientific achievement, and which had never been equalled in size and perfection anywhere else in the world. There was assembled also a working force of about forty thousand men, trained and disciplined in construction work, well housed, well fed, and carefully safeguarded against disease. The railway constructors had this equipment and this force to draw upon as they desired, and while the task before them was a formidable one, with such an agency at their command it was far from being insurmountable.

What they had to do was to construct a high-level railroad through what was mainly a low-level country.



The embankment across the valley of the Gatun River in first stages of construction, June, 1910.

They must have the level at all points higher than the 87-foot level of Gatun Lake. In building it they must cross wide and deep valleys and pierce rocky ridges and hills. The valleys were covered with dense jungle growth and traversed by numerous small streams. Their ground-levels, which were from 20 to 25 feet above sea-level, proved on examination to be composed of a mass of soft clay, decomposed wood and vegetation, from 150 to 200 feet in depth, resting upon a solid rock foundation. This mass had near the top a hard stratum of clay and sand from 20 to 30 feet in thickness, but the space between this crust and the rock foundation was filled with soft material. Across these valleys—one of them, that of the Gatun River, being about three miles in width—huge embankments had to be constructed, ranging in height from 58 to 74 feet. When the weight of these became too great for the crust to sustain, it pressed that down upon the soft material beneath and forced it to the surface on either side. This action added greatly to the amount of material in the embankments, for the upheavals had to be counterweighted, virtually doubling the width of the foundations, and the settlement of the ground surface, varying from 25 to 60 feet, added the distance in each case to the height of the embankment at the centre or road-bed line.

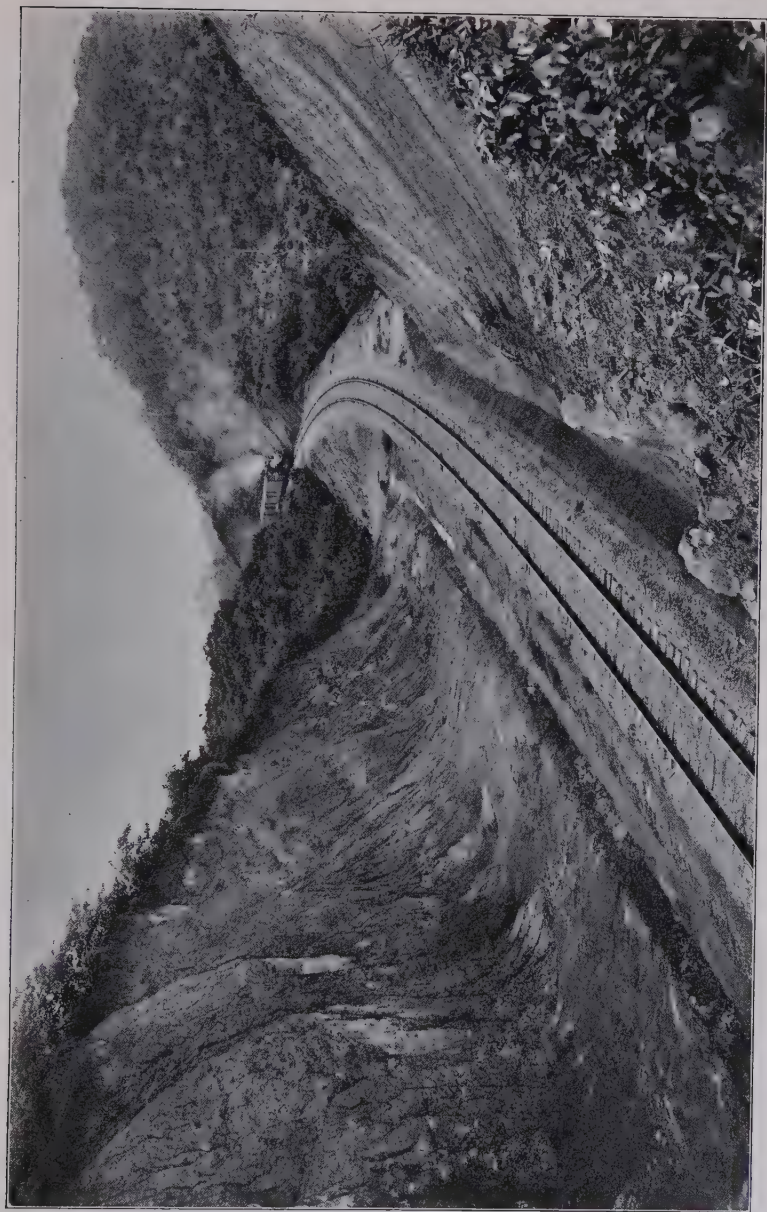
Some conception of the magnitude of the task may be formed by the statement that there were in all 167 embankments, containing a total of 16,000,000 cubic yards of material, and 164 cuts, the heaviest varying in depth from 60 to 95 feet. The three-mile fill across

the Gatun valley alone contained 5,000,000 cubic yards of material, and of the cuts one was 95 feet deep at the highest point, another 84 feet, another 80 feet, and another, through solid and very hard rock, 75 feet. It is not surprising, in view of these formidable obstacles, that the road cost nearly \$9,000,000, or about \$200,000 a mile. It had to be constructed where it was because higher ground could have been reached only by going outside the Canal Zone and over a much longer distance, and at a larger expense.

As originally planned, the line from Gamboa to Pedro Miguel was to run through Culebra Cut on the berm of the canal, but this route had to be abandoned because of the slides. It became necessary to run the line around Gold Hill through a very difficult region, for a distance of $9\frac{1}{2}$ miles, a change which added \$1,200,000 to the cost.

The work was completed and the road was turned over formally to the Panama Railroad Company on May 25, 1912, five years after construction began. Its length is a trifle less than that of the old line, the time of construction was about the same, and its cost about a million dollars greater. There all comparison ceases. The old line had no embankments worth mentioning, and only one cut, whose depth was 24 feet. Such a road as the new line would have been an utter impossibility a half-century earlier, for its difficulties would have been insurmountable and its cost, if construction had been attempted, would have been so tremendous as to be prohibitive.

It is an interesting fact, worthy of recording per-



New Panama Railroad. Gold Hill Line. Looking north up the Pedro Miguel Valley, June, 1912.

haps, that the original roadway was laid with ties of native wood which decayed so rapidly that soon after the road was open to traffic these were replaced almost entirely with ties of *lignum vitæ* brought from Cartagena, the northern province of Colombia. When the old line was torn up these ties, after being in the ground for a full half-century, were in almost perfect condition of preservation. Many ties of similar wood have been placed on the new line, but the greater part of its road-bed is laid with ties brought from the United States.

During the first two years of construction the work was in charge of Ralph Budd, chief engineer of the Panama Railroad. He resigned in September, 1909, and was succeeded by Lieutenant Frederick Mears, U. S. A., who was in charge till the road was completed.

CHAPTER XXIV

VALUE OF THE FRENCH PROPERTY — WHAT THE UNITED STATES RECEIVED IN RETURN FOR THE PAYMENT OF \$40,000,000 TO THE FRENCH COMPANY

DID the American Government get a good bargain when it paid the French canal company \$40,000,000 for its rights, privileges, and property on the isthmus? This question was answered decisively in the affirmative by the canal commission in May, 1911. A special committee, of which the secretary of the commission was chairman, was appointed by Colonel Goethals to ascertain the value of what the United States had received for the sum paid. The committee, after a thorough investigation, made a report which fixed the valuation at \$42,799,826, and this was adopted by the canal commission as its official appraisement.

In reaching its conclusions the committee took as a basis of inquiry the \$40,000,000 estimate which had been made by the Isthmian Canal Commission of 1899-1901, known as the Walker Commission. That commission had in mind a canal project which contemplated the use of about 39,500,000 cubic yards of the excavation accomplished by the French, and it estimated the value of this at \$27,474,000. The project was for a sea-level channel from Cristobal to Bohio, a lake from

Bohio to Pedro Miguel, an excavated channel from the locks at Pedro Miguel to Miraflores, and a sea-level channel from Miraflores to the Bay of Panama. For the canal, finally built, only about 30,000,000 cubic yards of the French excavation were useful, and the value of this was estimated by the committee at \$25,-389,240. In reaching this estimate, consideration was given to the fact that the excavation was pioneer work. It included clearing the ground and opening up the work, and also the diversion of several streams. It is probable that a large quantity of it was handwork, and although it was mostly earth, pioneer excavation is expensive. There was also a considerable amount of rock removed from Culebra Cut. For these reasons it was decided to value the excavation at the average price of excavation under American direction previous to June 30, 1909, at which time a total of about 40,-000,000 cubic yards of dry excavation had been removed. This average price was \$1.03 for dry excavation and 23 cents for wet.

Included in the purchase from the French were 68,-888 shares of Panama Railroad stock, par value \$100 each, leaving 1,112 shares in the hands of private parties. These 1,112 shares were purchased at a cost of \$157,118.24, or an average price of \$140. In arriving at the value to the canal commission of the 68,888 shares the average price paid for the outstanding shares was used. This gave a valuation of \$9,644,320. When it is considered that the railroad has been a very valuable asset to the commission, and that through ownership of the property the commission secured the

transportation of its freight and passengers at cost, besides using the Panama Railroad Company in many other ways, the valuation was unquestionably reasonable.

There were turned over by the French to the American Government 2,148 buildings, 1,536 of which were repaired and used. The estimated value of these, based on their value at the time of transfer, plus the value of repairs, 10 per cent to cover depreciation, was placed by the committee as follows:

Quarters, gold.....	\$625,483.63
Quarters, silver.....	443,800.30
Hotels.....	7,455.23
Hospitals.....	482,763.31
French Administration Building, Panama City.....	125,000.00
Building used as American Legation, Panama City.....	50,000.00
Jails.....	13,503.34
Schoolhouses.....	12,702.78
Shops.....	110,200.85
Storehouses.....	94,099.70
Structures.....	77,218.20
Miscellaneous buildings of old Department of Sanitation and Government.	11,976.46
Total.....	\$2,054,203.80

A careful inventory was made of the material and equipment received from the French, a large portion of which had proved of much value to the commission. This was especially the case with the floating equip-

ment of dredges and dump barges. By the expenditure of from \$20,000 to \$35,000 in repairs on seven dredges they were put into condition virtually as good as new, and during the entire period of construction were as serviceable, practically, as new dredges of the same type costing approximately \$100,000 each would have been. A great deal of the railway equipment was also very useful during the early days of American work, pending the arrival of the new equipment, and the same thing was true of the shop machinery and tools. Taking all these facts into consideration the committee made this estimate:

Floating equipment.....	\$651,000
Shop machinery and tools.....	111,076
Rolling stock.....	297,900
Scrap	294,071
Miscellaneous material.....	751,396
Air compressors.....	6,620
Total.	\$2,112,063

The French company purchased, during its existence, a total of 13,520 hectares of land, for which it paid \$535,120.73 Colombian money, then equivalent to \$428,096.58 gold. This land was included in the property transferred to the United States, but no estimate of its value was made by the commission of 1899-1901. The prices paid for those portions of these lands lying along the line of the canal do not vary materially from the prices paid by the United States for lands which it has purchased in similar localities since construction

began, but others of the French lands, notably those lying near the Pacific entrance of the canal, were purchased at much lower figures than they could be purchased for later. Taking as a basis for valuation the prices which the United States has paid for lands, both through private agreements and under awards made by joint commissions, it was the opinion of the committee that if the United States were not the owner of any of these lands, and was obliged to acquire them after the canal's completion, the cost would not be less than \$1,000,000.

The French left an extremely valuable collection of maps, surveys, drawings, and records. All their work of this kind was done in an admirable manner and proved to be of great use. The committee adopted as its estimate of the value of this material that which the Walker Commission had placed upon it, \$2,000,000.

The French constructed a channel in the Bay of Panama from Balboa to deep water, and this was used by the Americans for four years, it being the only approach for commercial shipping and for the delivery of supplies on the Pacific side during that period. The value of this use was placed at \$500,000.

There was also a considerable amount of clearing and road-making by the French at several points in the Canal Zone, notably at Ancon, Cristobal, and Empire. The committee considered the sum of \$100,000 a moderate estimate of the value of this work.

The net result of the committee's research was summarized as follows:

PERIOD OF CONSTRUCTION

329

Excavation.....	\$25,389,240
Panama Railroad stock.....	9,644,320
Maps, drawings, and records.....	2,000,000
Material and equipment.....	2,112,063
Buildings.....	2,054,203
Lands.....	1,000,000
Use of Pacific ship channel.....	500,000
Road-making and clearing.....	100,000
Total.....	\$42,799,826

CHAPTER XXV

AMERICAN AND FRENCH MACHINERY — RELATIVE CAPACITY OF THE TWO EXCAVATING PLANTS

THE difference in efficiency between the excavation plant of the French canal workers and that of the Americans is the measure of progress in mechanical invention during a quarter of a century. Taken as a whole, the efficiency of the American plant was about five times that of the French. In some branches of work it was much greater than that and in some it fell below, but that was the general average.

The chief defect in the French equipment was its lack of strength: it was all too light for the work it had to do. This was true of the railway tracks, locomotives, dirt cars, and the various forms of excavating machinery. All had been designed for operation in quite different material and under quite other conditions than existed on the isthmus. Some portions of it had been used successfully at Suez, and were taken to the isthmus with the expectation, based on lack of knowledge as to isthmus conditions, that they would work there equally well. They were effective, in their day, in soft earth and sand, but were not equal to the heavy rock and clayey soil with which they had to contend at Panama.

John F. Stevens, in his testimony before the International Consulting Board in 1905, said: "We criticise the French plant, but that is not fair. At that time it was considered a modern plant. I would liken it to a modern one as a baby carriage to an automobile. This is no reflection on the French, but I cannot conceive how they did the work they did with the plant they had."

The track and car equipment made rapid progress impossible. The Belgian rail in use was only 19.7 feet long, was $4\frac{7}{8}$ inches high, and only $3\frac{3}{4}$ inches wide at its base. The joints were close together, the rails were laid in soft wood, with no tie-plates under them, and the track itself was laid on soft ground, without ballasting. Then, too, the dirt cars, with a capacity of only from $5\frac{1}{4}$ to $8\frac{3}{4}$ cubic yards, had rigid axles and varying gauges. Mr. Dauchy, who was the engineer in charge of work in Culebra Cut under Mr. Wallace, said in his testimony before the International Consulting Board that in attempting to use the equipment he had fifteen or twenty derailments a day in consequence. "Take the French dump-cars," he said; "I found upon investigation that the wheel gauge of these cars varied in almost every individual car. You take a train of these cars and hardly any two cars had exactly the same wheel gauge. We found cases where the two pairs of wheels under a car were of different gauge." It was impossible, under these conditions, to keep the excavators supplied with trains, and the consequence was that they were idle a large part of the time. In the rainy season the wet, clayey material stuck fast to

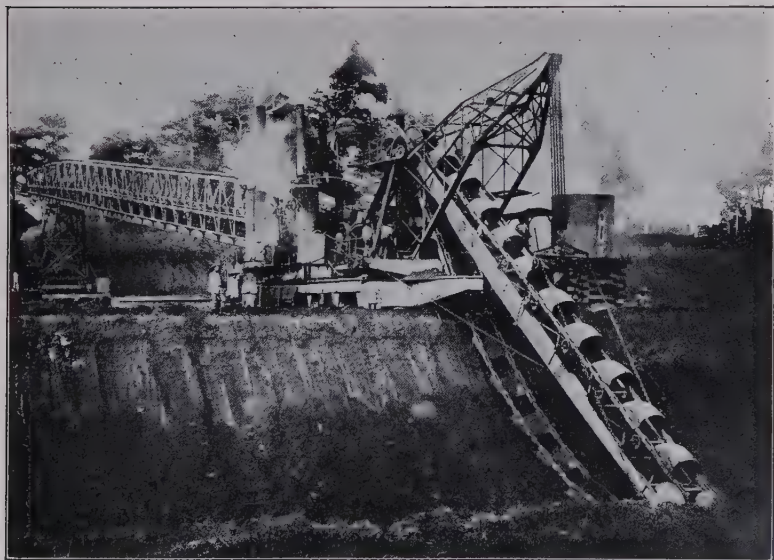
the cars, would not dump, and had to be shovelled out by hand.

The excavating machinery was as inadequate almost as the railway equipment. It comprised two kinds of excavators: the American steam-shovel, in its original and very crude form, and the French side or chain-bucket excavators. There were eleven of the American shovels in use, ten of them supplied by the Osgood Dredge Company, of Albany, N. Y., later the Marion-Osgood Company. Their frames were of wood, the boiler was vertical, the "stick" or handle of the dipper was of wood, and the capacity of the dipper was two cubic yards. They were used only in soft earth, being too light for work in rock, and had a capacity of about 56 cubic yards per hour. They were in service during the entire period of French activity, and one of them was repaired and used for a short time by the Americans in 1904, but was soon abandoned in favor of the modern powerful development of the same machine.

The French had altogether 116 chain-bucket excavators, with 20 to 22 buckets on the chain, the capacity of which ranged from 3 to 6 cubic feet. Of the total number, 86 were up-diggers and 30 were down-diggers. They emptied their buckets into dump-cars or upon transporters. The transporter was a truss or bridge about 180 feet long, through the centre of which was a belt of rubber or articulated steel plates, 3 feet 4 inches wide, travelling on rollers. It was designed to carry the spoil away from the canal prism and deliver it outside. In wet weather the clayey material stuck to the belt and the rollers, throwing the belt out



Culebra Cut, looking north, as left by the French. Americans using French equipment, December, 1904.



French transporter.

of its course and against the bars of the truss, tearing it and greatly hampering operation. The belt could not be given an inclination above ten per cent, and the best that the machine could accomplish was to transport material from 150 to 180 feet on level ground. It could transport at most about 1,400 cubic yards in a day of ten hours. The company had 20 of these machines.

The average output of the up-digger excavators was about 79 cubic yards per hour, but as they were in operation only about half the time the average output for a day of ten hours was about 400 cubic yards. The average output of the down-diggers was about 82 cubic yards an hour, and in a day of ten hours about 570 cubic yards. Their boilers were 30 horse-power and their weight about 65 tons. They were used down to the collapse of the first French company, and exclusively by the second company, and a few of them were used for a short time by the Americans in 1905.

Various other devices were employed by the second French company. They stretched seven cable-ways across Culebra Cut, with a span of 148 feet. On these, buckets loaded by hand were run and emptied into cars below. The average capacity of these was about 136 cubic yards in a day of ten hours. Another device was a kind of elevator, placed against the side of the excavation. A fixed inclined plane reached to the bottom of the cut, and on this a trolley track ran up and down. Decauville cars loaded by hand were pushed under the foot of the incline, fastened to the trolley, taken to the top, and emptied into dump-cars. This

machine was a fixed structure, and had to be dismantled when moved. It would have been useful as a permanent plant for loading coal, sand, or grain, but was virtually useless for the work which it was called upon to do.

Mr. A. Raggi, to whom I am indebted for the information in regard to French machinery contained in this chapter, and who was in the employ of the French company as an engineer, makes this general comment upon the company's methods and equipment:

The French always endeavored to increase the output of their excavation by modifying their plant. This explains the diversity of their machines. They were well built, of good material, but generally too small, too light, and of a too low capacity to meet the immense task that was before them. But the principal cause of trouble was the difficulty the French had to supply their excavators regularly with a sufficient number of cars. A large percentage of the loss of time was in "waiting for cars." This was due to the bad conditions of their tracks.

The I. C. C. experienced just the same trouble in 1904 and a part of 1905 until the French rail was replaced by the American rail. This explains why the French were not in favor of putting heavy equipment on their tracks, and always attempted to reduce the transportation on temporary tracks.

This is the reason why the New Company from the beginning adopted the cableways. Mr. de la Tournier, Inspector of Ponts et Chaussées, then in charge of the works, thought that with the cableways he needed but one well ballasted permanent track, on top of the bank, outside of the prism, and that he would dispense with the temporary tracks in the bottom of the Cut. But there he fell into another fault, the cable-

way was too slow and of a too small capacity for the work to be done.

When we compare the excavation equipment described in the foregoing pages with that assembled by the Americans a quarter of a century later the picturesque simile of Mr. Stevens—"as a baby carriage to an automobile"—does not seem far out of the way. The French, like all construction workers of the time, used hand-work mainly. The Americans, with all the remarkable improvements and developments of mechanical science at their command, were able to substitute for hand-work machines which did the work of hundreds, and in some instances, of thousands, of men.

The four great instruments of excavation in the American plant were steam-shovels, unloaders, spreaders, and trackshifters. None of these, except the first in crude form, was known to the French. The greatest of the four is the steam-shovel, capable in its most powerful form of removing in an eight-hour day 4,823 cubic yards of rock and earth, or 8,395 tons. This was the highest record attained during American work, and it was accomplished by a 90-ton shovel with a 5-cubic-yard dipper. It demonstrated the capacity of the machine when working under most favorable conditions. During the busiest season of work in Culebra Cut there was a daily average of 43 of these shovels in operation, and the monthly output of each averaged 36,786 cubic yards, or a daily average of 1,415 cubic yards. Frequently the output of a shovel reached 3,500 cubic yards in an eight-hour day. The amount depended mainly on the supply of dirt trains,

for the Americans, like the French, had an insufficient supply of these to keep the excavating machines in constant operation, but for different reasons. With the French poor tracks constituted the chief cause of delay; with the Americans the tracks were satisfactory, but there was an inadequate supply of cars because a full supply would require so large an equipment of cars and locomotives, unloaders, men, etc., as to greatly increase the cost.

The ability of the steam-shovel to remove at least five times as much material in an hour as the French implements is only a part of its superior efficiency. The 5-cubic-yard dippers can handle rock weighing from 10 to 12 tons, whereas by hand labor 150 or 200 pounds is the limit.

The result is that far less drilling and blasting and a much smaller quantity of explosives are required in getting rock material into condition for excavation, and consequently a smaller force of men. It is estimated that from two to three times as much drilling was required under the French conditions, twice as large a quantity of explosives, and three times as many men as under American conditions. The average amount of dynamite used by the Americans in the Culebra Cut is about one-half pound for every cubic yard of material blasted, while the French used not less than a pound for every cubic yard.

But while a less quantity of explosives was required than would have been necessary under old methods, the amount used on the isthmus during the period of canal construction has been enormous, and at its close



Track-shifting machine which does the work of 600 men.



Steam-shovel loading rock, Culebra Cut.

will aggregate no less than 77,500,000 pounds (38,750 tons), divided as follows:

	pounds
All canal work.....	75,000,000
Central division, mainly Culebra Cut.....	40,000,000
Panama Railroad.....	2,500,000

During the busiest period of work the amount of explosives used in Culebra Cut averaged about 6,000,-000 pounds a year.

The heaviest single blast was in the solid rock of Contractor's Hill, in the Cut, on November 12, 1906, which contained nearly 26 tons of dynamite and black powder. The second in size was at Bas Obispo, on December 12, 1908, containing 22 tons of dynamite, which went off prematurely from causes never ascertained, killing 23 people and injuring 40 others. The third in size was at Caimito, on the canal line, in February, 1908, in which $19\frac{1}{2}$ tons of dynamite were used.

Most of the material excavated in Culebra Cut consisted of rock varying from very soft, which readily disintegrates on exposure to the atmosphere, to very dense rock of great hardness. It was necessary before excavating this material to drill and blast it. Two kinds of drills were used—tripod and well—both obtaining their power from a 10-inch compressed-air main on the west bank of the Cut supplied by three batteries of air-compressors placed at equal distances along the 9 miles of the Cut. The usual depth of drill holes was about 27 feet, three feet deeper than the

steam-shovels excavated. The drill holes, placed about 14 feet apart, were loaded with 45 per cent potassium citrate dynamite in quantities depending upon the character of the rock, and connected in parallel and fired by means of a current from an electric light plant. The maximum number of drills in use at any one time in Culebra Cut was 377, of which 221 were tripod and 156 well. With these over 90 miles of holes have been drilled in a single month.

With the modern unloader, the second of the great American excavation instruments, the saving in labor is greater than in the case of the steam-shovels. This machine was unknown to the French. It consists of a steel plough, weighing about $3\frac{1}{2}$ tons, which is drawn from one end of a train of flat cars to the other by means of a cable which is wound on a steam-driven drum. The flat cars upon which it is operated have one high and one open side, and are connected by steel aprons which convert their floors into a continuous surface throughout the train's entire length. As the wedge-shaped plough, which has a surface sloping backward on the open side of the car, moves forward, the material runs off in a continuous stream. The flat-car train is composed generally of 20 cars, each with a capacity of about 19 cubic yards, or 610 tons for the train. An unloader will empty an entire train in from 7 to 15 minutes. There is a record of one of these machines unloading in an eight-hour day 18 trains, about $3\frac{1}{2}$ miles of cars, containing about 7,560 cubic yards of material. It is estimated by the engineers in charge of the work that 20 of these machines with a force of



A spreader at work, Corozal Dump, August 31, 1907.



Dirt train and Lidgerwood unloader, Juan Grande, January, 1907.

120 laborers do the work of 5,666 men under the old method of unloading by hand.

Another machine, also unknown to the French, is the spreader, which is a car operated by compressed air, which has steel wings on each side that can be raised and lowered, and when lowered reach out from the rails, with a backward slope, for a distance of $11\frac{1}{2}$ feet. As the car moves forward the material left in a ridge along the side of the track by the unloader is spread out on a level with that on which the tracks rest. This machine, like the unloader, does the work of between 5,000 and 6,000 men working by hand.

Finally, after the steam-shovels have lifted the material on flat cars, after the unloaders have deposited it at its destination, and after the spreaders have reduced it to a level mass, there comes still another labor-saving machine, also unknown to the French, the track-shifter. This is the invention of an American, W. G. Bierd, who was the general manager of the Panama Railroad Company from September 2, 1905, to October 1, 1907, when he resigned on account of ill health, the climate of the isthmus not agreeing with him. He is at present vice-president and general manager of the Minneapolis and St. Louis Railway Company. The machine was first put in service in January, 1907. It consists of a flat car from which a steel truss boom extends 35 feet in front over the track, and a second boom extends 30 feet from the side parallel to and above the level of the track. A cable running over the end of the first boom lifts a section of the track, rails and ties together, and a cable running through the end of the second

boom pulls the raised section sidewise. As first operated the machine carried its own engine, and swung a section of track five feet to one side. It now takes its steam from a locomotive and is capable of swinging track a distance of 9 feet. It is handled by a force of nine men and is capable of moving 5,400 feet, or one mile and 120 feet, of track 9 feet in eight hours, doing the work of about 600 men for the same length of time. This has been of great service on the dumps where the unloaders had deposited the spoil and the spreaders had reduced it to a level, and it was necessary to move the tracks constantly to the edge of the dumps. In the busiest period of excavation the American plant* comprised 101 steam-shovels, 45 with 5-cubic-yard dippers and the others with dippers varying from $2\frac{1}{2}$ to 3 cubic yards, 30 unloaders, 26 spreaders, and 9 trackshifters. It comprised also 161 powerful modern locomotives, 1,760 flat cars for unloaders of 19-cubic-yard capacity, and 1,800 dump-cars, varying in capacity from 10 to 17 cubic yards. With this equipment there was removed from Culebra Cut in March, 1913, 1,183,290 cubic yards of material. The highest monthly total of the French at the same point was 282,528 cubic yards. The American force in the Cut in March, 1913, was about 7,000 men. The working French force, thirty years earlier, was about 9,000, as nearly as can be ascertained. The monthly results per man, as shown by these figures, were for the American 176 cubic yards and for the French 32 cubic yards, or more than five to one in favor of the Americans. The

* Appendix D.

American gain, as has been set forth in preceding chapters, is due to the advance in mechanical invention, and is in no sense a reflection upon the work done by the French. After an examination of their implements, one is impelled to share with Mr. Stevens a feeling of wonder that they were able to accomplish as much as they did.

CHAPTER XXVI

VETERANS IN THE CANAL SERVICE

It has been said of the canal work that it was a "young man's job," and that consequently it could show no list of veterans in the proper sense of the word. This is true as a general statement, so far as employes are concerned, for not only were young men sought for the work, both at the outset and during its progress, but persons over thirty years of age were barred from some forms of employment, those over forty from others, and those over forty-five from all. These rules applied only to minor positions; there was no fixed age limit on official and other of the higher positions. But aside from formal limitations, the task was a young man's job in that it had about it little to attract men well along in life. There were too many risks involved, and too great demands made upon physical powers. The result was that the great body of the canal force was composed of young men, who, after six to nine years of service, were still far away from old age.

A collection of the photographs of veterans, such as is displayed in this chapter, should be viewed in the light of the foregoing observations. The persons depicted therein are real veterans, not in years, but in service well, faithfully, and unostentatiously performed.

The oldest veteran in the list is A. Raggi, who was in the service of the new French canal company, in charge of excavation in the Culebra Cut, from 1895 to 1904. He was retained in the service of the Americans when they took possession, acting as an assistant engineer on surveys, projects, estimates, etc., till 1907, when he was placed in the office of the office engineer of the canal commission, with duties connected with topographical work, geological surveys, records, etc., a position which he still holds.

A. B. Nichols went to the isthmus in May, 1904, arriving with John F. Wallace, the first chief engineer. He had charge of the surveys at Gatun until June, 1905, when he was made resident engineer of the Culebra division, holding that position for about a year when he was appointed by Colonel Goethals office engineer of the commission, a position which he has since retained.

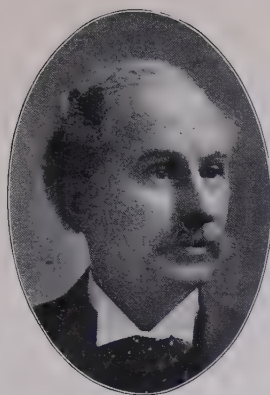
George M. Wells, who might be called the boy veteran of the canal, went to the isthmus in June, 1904, as a transit man. He served under Mr. Wallace and Mr. Stevens as transit man, instrument man, and assistant engineer in connection with survey work. Subsequently he had charge of designing work in the Colon dredging division, of construction work at Porto Bello, and of the designs for and construction of the handling plant of Gatun Locks. Since September, 1909, he has been office engineer of the Atlantic Division in charge of the designing office, of the municipal works of that division, and of the design and construction of permanent water-works and purification plants for Gatun,

the cities of Colon and Panama, and the southern end of the canal.

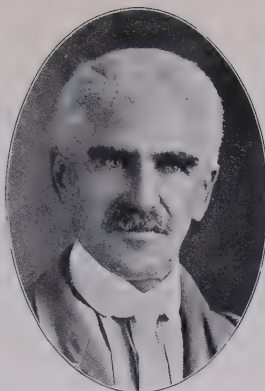
W. G. Comber, who has won the title of the "veteran mud-digger of the isthmus," entered the canal service in August, 1905. He was in charge of dredging at the Atlantic entrance till February 1, 1907, when he was transferred to the Pacific entrance and made division engineer. Under the new organization which was put into effect in July, 1908, he became resident engineer at the same point, and on May 1, 1913, he was placed, by order of Colonel Goethals, in charge of all dredging operations on the isthmus.

James Macfarlane entered the canal service in January, 1905, having been on the isthmus in the employ of the Panama Railroad Company since August, 1901. He was in charge of the marine equipment of the canal commission at both ends of the canal for a time, and later became superintendent of floating equipment at Balboa, holding that position under Mr. Comber till August, 1910, when he was appointed superintendent of dredging, a position which he has held since that time.

Mr. A. S. Zinn entered the service in October, 1906, as resident engineer of the Central Division, which includes Culebra Cut, and has retained that position throughout the entire period of active work. He has had charge of all division estimates and plans, the most important being railway tracks, stone-crushers, dumps, fifteen miles of pile trestles, five miles of diversion canals, Naos Island breakwater, and the temporary suspension bridge over the Cut at Empire.



A. B. Nichols.



A. Raggi.



A. S. Zinn.



George M. Wells.



W. G. Comber.



James Macfarland.



Eduard J. Williams.



Mark W. Tenny.



Thomas M. Cooke.

Veterans in the Canal service.

Thomas M. Cooke entered the service in July, 1904. He organized what became later the division of posts, customs, and revenues, and has remained as its head throughout the entire period of construction. He has had charge of the customs work at both the Atlantic and Pacific terminals, of the collection of license fees, taxes, and land rents, and of the maintenance and operation of seventeen post-offices along the line of the canal. Down to May, 1913, there had been issued money orders amounting to \$31,731,592; the post-office receipts had aggregated \$716,679, and collections from all other sources had reached \$1,480,188. Under the postal agreement with the Republic of Panama, \$280,878 had been paid to its government for postage-stamps.

Edward J. Williams has been disbursing officer of the Isthmian Canal Commission since November, 1905, and has had charge of all expenditures by the commission since that time. Down to May 1, 1913, there had passed through his office, for all purposes, cash to the amount of \$195,577,988.00.

Mark W. Tenny entered the service of the Isthmian Canal Commission as instrument man on May 14, 1904. In March, 1905, he was appointed assistant engineer, and in February, 1913, superintendent of construction of the Culebra district of the Central Division.

The men whose careers are set forth above do not by any means exhaust the list of deserving veterans. They are merely the more notable samples of a large class, because of the positions which they held. The veteran

list would have been much longer than it is had the work remained under civilian direction. When it passed under military direction, many of those who had held high engineering positions resigned, not through dissatisfaction with the rule of Colonel Goethals, or through anticipation of discharge, but because nearly all doors to promotion were closed by the new order of things. The higher positions were all filled with army officers, and would remain so filled till the end of the task, for as one officer retired or was transferred elsewhere, another was detailed to take his place. Colonel Goethals, so far as was in his power, not only retained the civilians whom he found in important positions, but he appointed other civilians to some of the highest positions, placing one of them, Mr. S. B. Williamson, at the head of one of the three great divisions. But these were exceptions to the general rule. Not only were the best places held by army officers, but they received higher salaries than the civilians in similar positions. The two army officers who were at the head of the other two of the great divisions received \$14,000 a year each as members of the commission, while Mr. Williamson's pay was only \$10,000.

This situation, inevitable under the circumstances, was calculated to drive civilians who were ambitious out of the service, and many of them resigned soon after the change to military control was effected. Others, like Mr. Williamson, retired later when the work neared completion.

Of the men who went to the isthmus from the United States during the first year of work, 1904, there re-

mained in the service in 1913, about sixty. These were all full-fledged veterans, who had been on the job from its very beginning, had withstood the yellow-fever panic of 1905, and who would be at their posts at the close, provided their lives were spared. Of those who joined the force in 1905, about four hundred were still in the service in 1913. Many of these also had withstood the yellow-fever panic, and the others had arrived soon after it had subsided. If they were not full-fledged veterans, they were entitled to rank very closely with the men of 1904, for like them they had stuck to their posts through the dangers and hardships which had marked the early period of the work, when life on the isthmus was much less agreeable than it became afterward.

PART V
THE COMPLETED CANAL

PART V

THE COMPLETED CANAL

CHAPTER I

NOT A CANAL THROUGH THE ISTHMUS, BUT A BRIDGE OF WATER ABOVE IT

THE Panama Canal is a huge water bridge, the first in the world's history. It is about 34 miles in length, 87 feet high, with a channel of water through its centre varying in depth from 45 to 87 feet, and in width at the bottom from 300 to 1,000 feet. The bridge is divided into two sections, Gatun Lake and Culebra Cut, the latter being an arm of the former. Access to the bridge by vessels will be by means of water elevators, six in duplicate at either end, each 1,000 feet long, 110 feet wide, and with a combined lift of 87 feet. At the Atlantic end the elevators are grouped one above another like a flight of three steps. At the Pacific end two pairs of elevators are grouped at the bottom, and are separated from the third pair above by a platform of water in the form of a lake about a mile and a half in length. The piers or walls which hold the bridge in place are the Gatun Dam and elevator gates at the Atlantic end, and the dam and elevator gates at Pedro Miguel on the Pacific end.

In constructing the bridge and securing a level for its channel it was necessary to cut a passage through a mountain range near the Pacific end and to erect a lower mountain range or ridge at the Atlantic end. The first is known as the Culebra Cut, and the second, composed in large part of the earth and rock taken from the Cut and transported about 30 miles, is known as the Gatun Dam. A mountain had to be moved, not by faith, but by dynamite, steam-shovels, and railway trains, and set up 30 miles away. It was placed across the lower end of a valley or watershed comprising 1,320 square miles, and will form in that valley a lake with an area of 164 square miles, with a depth varying from 45 to 87 feet, and containing 183 billion cubic feet of water. This lake, with its Culebra Cut arm, is the water bridge of the isthmus. Twenty-four miles of the channel for vessels will lie within the lake area, and about 9 miles will be through Culebra Cut, and these 9 miles constitute all that can be called a canal in the usual sense, unless the sea approaches at either end be included in that designation.

The canal does not, as is generally supposed, cross the isthmus from east to west. It runs due south from its entrance in Limon Bay, through the Gatun locks to a point in the widest portion of Gatun Lake, a distance of about $11\frac{1}{2}$ miles; it then turns sharply to the east and follows a course generally southeastern, till it reaches the Bay of Panama. Its terminus near Panama is about $22\frac{1}{2}$ miles east of its terminus near Colon. Its length from shore-line to shore-line is

about 40 miles, and from deep water in the Atlantic to deep water in the Pacific is about 50 miles.

In passing through the canal from the Atlantic to the Pacific, a vessel will enter the approach channel in Limon Bay, which has a bottom width of 500 feet and extends to Gatun, a distance of about 7 miles. At Gatun it will enter a series of three locks in flight and be lifted 85 feet to the level of Gatun Lake. It may steam at full speed through this lake, in a channel varying from 1,000 to 500 feet in width, for a distance of about 24 miles to Bas Obispo, where it will enter the Culebra Cut. It will pass through the Cut, a distance of about 9 miles, in a channel with a bottom width of 300 feet to Pedro Miguel. There it will enter a lock and be lowered $30\frac{1}{3}$ feet to a small lake, at an elevation of $54\frac{2}{3}$ feet above sea-level, and will pass through this for about $1\frac{1}{2}$ miles to Miraflores. There it will enter two locks in series and be lowered to sea-level, passing out into the Pacific through a channel about $8\frac{1}{2}$ miles in length, with a bottom width of 500 feet. The depth of the approach channel on the Atlantic side, where the maximum tidal oscillation is $2\frac{1}{2}$ feet, will be 41 feet at mean tide, and on the Pacific side, where the maximum oscillation is 21 feet, the depth will be 45 feet at mean tide. The mean sea-level in both oceans is the same.

Throughout the first 15 miles from Gatun the width of the lake channel will be 1,000 feet, then for 4 miles it will be 800 feet, and for 4 miles more, to the northern entrance of Culebra Cut at Bas Obispo, it will be 500 feet. The depth will vary from 87 to 45 feet. The

water-level in the Cut will be that of the lake, the depth 45 feet.

Three hundred feet is the minimum bottom width of the canal. This width begins about half a mile above Pedro Miguel locks and extends about 8 miles through Culebra Cut, with the exception that at all angles the channel is widened sufficiently to allow a 1,000-foot vessel to make the turn. The Cut has eight angles, or about one to every mile. The 300-foot widths are only on tangents between the turning-basins at the angles. The smallest of these angles is $7^{\circ} 36'$, and the largest 30° .

In the whole canal there are 22 angles, the total curvature being $600^{\circ} 51'$. Of this curvature $281^{\circ} 10'$ are measured to the right going south, and $319^{\circ} 41'$ to the left. The sharpest curve is $67^{\circ} 10'$.

CHAPTER II

GATUN DAM, SPILLWAY, AND HYDRO-ELECTRIC STATION

WHEN, in November, 1906, President Roosevelt stood on a hill at Gatun a few rods above the site of the present lock, there was only a short and shallow trench to show that real work for construction had begun. Below, stretching away to the south, was the valley of the Chagres, through which that river and the French canal and the Panama Railroad stretched in nearly parallel lines. In front, nestled cosily in a bend of the Chagres, was the native village of Gatun, one of the most picturesque objects on the line of the railway. It had in its centre a quaint old church with a tumbled-down front door, a parsonage and school building, and a hundred or more other buildings and thatched-roof huts. Its population numbered about six hundred persons, and it was a market-place for produce which was brought in *cayucos*, or dugouts, from the various villages along the river. Beyond the village, looking across the valley, was an uneven stretch of country thickly covered with jungle growth. The site of the proposed dam, it was explained, would lie directly over the village and across the valley to the hills beyond. So dense was the tropical growth that the surface line of the dam could scarcely be followed by the eye.

Six years later the great dam was in place across the valley, the site of the old village was buried a hundred feet below, and stretching away to the south as far as the eye could reach was a great lake, its waters filling the valley and climbing far up upon the sides of its enclosing hills. Village and railway had been transplanted to higher ground, and the bed of the Chagres and the French canal had disappeared forever from view.

The site for the dam had been examined thoroughly before it was decided upon as satisfactory by Mr. Stevens, but it was not till five hundred and seventy-three acres of forest and jungle had been cleared that its really remarkable suitability was disclosed so clearly as to command instant approval by all competent observers. It then appeared that there was lying in the passage which Nature had left open between the converging lines of encircling hills a valley divided nearly in the centre by an isolated hill. When examined this hill was found to be composed of rock and to be about one hundred and ten feet in height, or about the elevation of the proposed dam. This made possible the construction, not of one great unbroken dam nearly a mile and a half in length, but of two dams, each about three-quarters of a mile in length; one of them, the east dam, wedded firmly to the hills in which the locks were to be placed at one end and to the centre hill at the other; the second, the west dam, wedded firmly to the centre hill at one end and to the high range of hills which bounds the west side of the valley at the other. The centre hill itself supplied virtually ideal

conditions for the construction of a spillway through which the waters of the Chagres could flow during the period of dam construction and in which the surplus waters of the great lake after construction had been completed could be regulated and controlled. It also added greatly to the strength of the dam as a whole.

Before work was begun on the dam an exhaustive examination was made of the foundation upon which it was to be placed in order to determine the character of the underlying materials; to ascertain whether there was any possible connection between the swamp areas to the north and the ocean to the south through the deposits in the gorges across which the dam was to be built; to test the ability of the underlying material to support the proposed structure; and to discover whether there could be obtained in the immediate vicinity material for the hydraulic fill which was to form the core of the dam. As a result it was ascertained that the underlying material was impervious to water; that there was no connection between the swamps above and the sea below; and that the underlying material possessed ample strength to uphold the weight that the dam would impose.

Considered as a single structure, the Gatun Dam is nearly one and one-half miles long, measured on its crest; nearly one-half mile wide at the base; about 400 feet wide at the water surface; about 100 feet wide at the top, and its crest is at an elevation of 105 feet above mean sea-level. It is in reality a low ridge uniting the high hills on either side of the lower end of the Chagres valley, so as to convert the valley into

a huge reservoir. Of the total length of the dam only 500 feet, or one-fifteenth, will be exposed to the maximum water-head of 85 to 87 feet. The interior of the dam is formed of a natural mixture of sand and clay, dredged by hydraulic process from pits above and below the dam, and placed between two large masses of rock and miscellaneous material obtained from steam-shovel excavation at various points along the canal. The top and up-stream slope are thoroughly ripped. The entire dam contains about twenty-one million cubic yards of material.

Work began upon it in July, 1907, when the foundation was cleared of timber and other growth, and trestles were erected for dumping excavated material for the erection of the two outer walls or toes. On August 10, 1907, by this process the Chagres River was dammed for the first time, and its waters were turned into the west diversion, a channel which had been constructed by the French to keep the waters of the Chagres out of their canal. This served as an outlet for the Chagres till April 24, 1910, when advancing construction closed it and the waters of the river were forced through the spillway and thus brought under control for future use.

The dry material in the toes of the dam was nearly all in place at the end of 1912. Only a few thousand cubic yards remained to be placed to finish off the crest. The hydraulic fill, pumped in by suction dredges, was started in December, 1908, and completed in September, 1912. The core thus created was carried to a height of ninety-five feet. It is composed of blue clay so impervious that it was very slow to dry out.

In its watery condition it flowed into every interstice in the ridges of rock and earth, until the whole mass at the centre of the dam became like a rubble wall, every rock in it cemented to another. The argillaceous sandstone, or blue rock, found everywhere on the isthmus, hard until exposed to air, is formed of such clay; and it is thought probable that in time the core of the dam itself will solidify into such rock.

On top of the hydraulic material there was dumped a dense clay found in near-by borrow pits, bringing the core up to the 105-foot level. The workers on the dam, under the direction of Americans, included Spaniards, Italians, Greeks, East Indian coolies, and West Indian negroes. They numbered 200 in 1907 and 2,000 when the force was at its maximum in 1911. When the work was at its highest point, 4 suction dredges were employed and 100 train-loads of rock and earth were dumped daily.

The spillway is a concrete-lined channel 1,200 feet long and 285 feet wide, the bottom being 10 feet above sea-level at the up-stream end and sloping to sea-level at the toe. Across the up-stream or lake opening of this channel there is a concrete dam in the form of an arc of a circle making its length 808 feet, although it closes a channel with a width of only 285 feet. The crest of the dam is 69 feet above sea-level, or 16 feet below the normal level of the lake. On the top of this dam there are 13 concrete piers with their tops 115.5 feet above sea-level, and between these there are regulating gates of the Stoney type. The gates have steel sheathings on a framework of girders and move up

and down on roller trains in niches in the piers. They are equipped with sealing devices to make them watertight. Machines for moving the gates are designed to raise or lower them in approximately ten minutes. The highest level to which it is intended to allow the lake to rise is 87 feet above sea-level, and it is probable that this level will be maintained continuously during wet seasons. With the lake at that elevation, the regulation gates will permit a discharge of water greater than the maximum known discharge of the Chagres River during a flood. Work on the spillway began in April, 1907, and was completed in 1913.

Adjacent to the north wall of the spillway there is located a hydro-electric station capable of generating through turbines 6,000 kilowatts for the operation of the lock machinery, machine shops, dry-dock, coal-handling plant, batteries, and for the lighting of the locks and zone towns, and operating the Panama Railroad. The building is constructed of concrete and steel, and is of a design suitable for a permanent powerhouse in a tropical country. The dimensions permit the installation of three 2,000-kilowatt units, and provision is made for a future extension of three additional similar units. It is rectangular in shape, and contains one main operating floor, with a turbine pit and two galleries for electrical equipment. The building, with the machinery and electrical equipment, is laid out upon the unit principle, each unit consisting of an individual head-gate, penstock, governor, exciter, oil-switch, and control panel.

Water is taken from Gatun Lake, the elevation of

which varies with the seasons from 80 to 87 feet above sea-level, through a forebay which is constructed as an integral part of the curved portion of the north spill-way approach wall. From the forebay the water is carried to the turbines through three steel-plate pen-stocks, each having an average length of 350 feet. The entrances are closed by cast-iron head-gates and bar-iron trash-racks. The head-gates are raised and lowered by individual motors which are geared to rising stems attached to the gate castings. The driving machinery and the motors are housed in a small concrete gate-house erected upon the forebay wall directly over the gate recesses and trash-racks. The gate-house is constructed for the present requirements of three head-gates, and provision is made for a future addition of three more units.

CHAPTER III

LOCKS AND GATES

ALL locks of the canal are in duplicate, are constructed in the same manner, and their chambers, with walls and floors of concrete, have the same usable dimensions—1,000 feet long and 110 feet wide. There are six pairs, making 12 in all. The side walls are from 45 to 50 feet wide at the surface of the floor, are vertical on the chamber side, and narrow on the outside from a point $24\frac{1}{2}$ feet above the floor, by means of a series of steps each 6 feet high, to a width of 8 feet at the top. The centre walls are 60 feet wide, with perpendicular faces. At a point $42\frac{1}{2}$ feet above the floor, and 15 feet above the top of the middle culvert, a space much like the letter U in shape is left open, measuring 19 feet in width at the bottom and 44 feet at the top. In this centre space is a tunnel divided into three stories, or galleries; the lowest gallery for drainage, the middle for the wires that carry the electric current to operate the gate and valve machinery installed in the centre wall, and the upper a passageway for the operators.

All walls are approximately 81 feet high, except in the lower pair of locks at Miraflores, where, for reasons which will be given later, they are 82 feet high. In

those at Gatun about 2,000,000 yards of concrete were used, and in those at Pedro Miguel and Miraflores, nearly 2,400,000. Work on the locks at Gatun began in September, 1906, when the task of clearing the site down to the rock foundation was instituted. Five years later when this task was completed, about 6,000,000 cubic yards of material had been removed.

On the Pacific side, work on the locks began nearly two years later than at Gatun. This was due mainly to the change in plan for that portion of the work, described in a previous chapter, by which Miraflores was made the site of the two locks which under the original plan had been placed at La Boca, now Balboa. Work began at Miraflores in January, 1908, and at Pedro Miguel in June of the same year, when excavation of the lock site was instituted.

The first concrete was laid in the locks at Gatun on August 24, 1909, in those at Pedro Miguel on September 1, 1909, and at Miraflores in July, 1910. The cracked stone for those at Gatun was brought by water from Porto Bello, about twenty miles east of Colon, and the sand from Nombre de Dios, about twenty miles further east. These were thought to be the nearest points at which suitable stone and sand could be procured. Stone for the locks on the Pacific side was taken from Ancon Hill, about four miles from the lock site, and the sand was brought by water from Point Chamé, in the Bay of Panama, about twenty-three miles west of Balboa. Rock-crushing plants were erected at Porto Bello and on Ancon Hill.

For handling the stone, sand, and cement and laying

the concrete two different plants were erected. That at Gatun was an elaborate plan of automatic railways and aerial cable-ways, operated by electric power. That at Pedro Miguel and Miraflores was a system of berm and chamber cranes. Full descriptions of the two plants are obtainable in the annual reports of the Isthmian Canal Commission for 1909 and 1910, and in issues of the *Canal Record* for those years. Concrete laying for the locks was completed at all points in the summer of 1913.

The longest approach walls are at the south entrances at Pedro Miguel and Miraflores—1,200 feet. At the north entrances of the locks they are 1,185 feet in length. That at the north entrance at Gatun is 1,031 feet long, and that at the south entrance 1,009 feet. Both approach walls at Pedro Miguel rest on solid rock foundations; at Miraflores the one at the south entrance rests on rock, and that at the north entrance rests on concrete piers of caisson construction sunk to rock. At Gatun the one at the north entrance in the lake rests upon piles driven from 35 to 70 feet into the ground; the one at the south rests on long piles reaching to rock, which in some places is over 100 feet below sea-level. Cellular form of reinforced concrete is used in all approach walls except those at the lower locks at Gatun and Miraflores, where mass concrete is used because of the effect of salt water on steel reinforcement.

The lock gates, each composed of two leaves, are of much larger dimensions than any previously made. Each leaf is 65 feet wide, from 47 to 82 feet high, 7 feet thick, and weighs from 390 to 730 tons. There are

92 leaves in all, and their combined weight is 60,000 tons. Placed end to end they would make a tower more than a mile and a quarter high.

They are constructed to float like a ship. Each is a huge webbed steel box, the girders of which are covered with a steel sheathing. All portions of the interior are accessible, with water-tight compartments providing for an adjustment of the buoyancy so as to control within limits the dead load on the bearings, making the leaf practically float in the water. This water-tight compartment is subdivided vertically into three sections, each independently water-tight, so that if the shell should be broken in any way, or begin to leak, only one section would probably be affected. An air-shaft, 26 inches in diameter, runs from the bottom compartment up to the top of the gate, and this also is water-tight where it passes through the upper half of the leaf.

The girders are made with man-holes through the webs, providing communication from the top to the bottom of the leaf, and are connected by several sets of vertical-transverse diaphragms of solid plates, running from top to bottom of the leaf, thus making a cellular construction, and dividing the spaces between the horizontal girders into small pockets, all of which are accessible through man-holes.

Each leaf rests at the bottom of its heel post upon a hemispherical pivot of forged nickel steel, and is hinged at the top to the masonry of the lock wall. It swings free on the pivot like a door, without wheels or other support beneath it.

Intermediate gates are used in all except one pair of

locks, and are so placed as to divide the space into two chambers, one 600 and the other 400 feet in length. This makes possible a saving of water and time in locking small vessels through, about 95 per cent of vessels navigating the high seas being less than 600 feet in length.

The highest gates and the highest lock walls on the canal are those of the lower locks at Miraflores, and these locks are the only ones which have no intermediate gates. The total lift from mean sea-level to the level of Miraflores Lake, $54\frac{2}{3}$ feet, is equally divided between the upper and lower locks, and under ordinary conditions all should be of equal volume. The waters of the Pacific, however, extend into the lower locks, and the range of tide is from 10 feet below to 10 feet above mean sea-level. Furthermore, the area of the upper locks is greater than the lower, because of the omission of the intermediate gates in the latter. The combined result is that the volume of each lower lock is less than that of the upper when the tide is higher than about 2 feet below mean tide, and the lock is incapable of receiving the full contents of an entire upper lock without causing an overflow of the walls and gates. A portion of the water from an upper lock must be wasted through the culverts, or cross-emptied into the twin lock. To diminish this waste as much as practicable, the volume of the lower locks has been enlarged by increasing the height of the walls and gates to 82 feet, which is the maximum consistent with economy and safety in construction.

The locks are filled and emptied through a system

of culverts. One culvert, 254 square feet in area of cross-section, about the area of the Hudson River tunnels of the Pennsylvania Railroad, extends the entire length of each of the middle and side walls, and from each of the large culverts, there are several smaller culverts, 33 to 44 square feet in area, which extend under the floor of the lock and communicate with the lock chamber through holes in the floor. The large culverts are controlled at points near the mitre gates by large valves, and each of the small culverts extending from the middle wall feeds in both directions through laterals, thus permitting the passage of water from one twin lock to another, effecting a saving of water.

To fill a lock the valves at the upper end are opened and the lower valves closed. The water flows from the upper pool through the large culverts into the small lateral culverts, and thence through the holes in the floor into the lock chamber. To empty a lock, the valves at the upper end are closed and those at the lower end are opened, and the water flows into the lower lock or pool in a similar manner. This system distributes the water as evenly as possible over the entire horizontal area of the lock, and reduces the disturbance in the chamber when it is being filled or emptied.

The depth of water over the mitre sills of the locks will be forty feet in salt water, and forty-one and one-third feet in fresh water.

The average time for filling and emptying a lock is about fifteen minutes, without opening the valves so suddenly as to create disturbing currents in the locks or approaches. The time required to pass a vessel

through all the locks is estimated at three hours; one hour and a half in the three locks at Gatun and about the same time in the three locks on the Pacific side. The time of passage of a vessel through the entire canal is estimated as ranging from ten to twelve hours, according to the size of the ship and the rate of speed at which it can travel.

CHAPTER IV

PASSAGE OF THE LOCKS

No vessel is permitted to enter or pass through the locks under its own power. The worst accidents which have occurred in locks hitherto have been due to an engineer in the engine-room misinterpreting a signal from the bridge, either going ahead when he should have gone back, or *vice versa*, and ramming a gate. When a vessel arrives at a lock at Gatun or Miraflores, it is tied up to the approach wall and turned over to the absolute control of the canal authorities. These place a representative of their own on the bridge and another in the engine-room. They then connect the towing locomotives, or "electric mules," with the ship. These locomotives operate on tracks, on the lock walls, and proceed at the rate of two miles an hour. The number of locomotives varies with the size of the vessel. The usual number required is four: two ahead, one on each wall, imparting motion to the vessel, and two astern, one on each wall, to aid in keeping the vessel in a central position and to bring it to rest when entirely within the lock chamber. They are equipped with a slip drum, towing windlass, and hawser, which permits the towing line to be taken in or paid out without actual motion of the locomotive on the track.

The locomotives run on a level, except when in passing from one lock to another they climb heavy grades. There are two systems of tracks, one for towing and the other for the return of the locomotives when not towing. The towing tracks have centre racks or cogs throughout, and the locomotives always operate on this rack when towing. At the incline between locks the return tracks also have rack rails, but elsewhere the locomotives run by friction. The only crossovers between the towing and return tracks are at each end of the locks, and there are no switches in the rack rail.

Before a lock can be entered, a fender chain, stretched across the walls of the lock, must be passed. If all is proceeding properly, this chain is dropped in its groove at the bottom of the channel. If by any chance the ship is moving too rapidly for safety, the chain remains stretched and the vessel runs against it. The chain, which is operated by hydraulic machinery in the walls, then plays out slowly by automatic release until the vessel is brought to a stop. The chain, which weighs 24,098 pounds, and is the strongest ever made, is capable of stopping a 10,000-ton ship, running at four miles an hour, within 73 feet, or less than the distance between the chain and the first gate.

If the vessel, by a remote possibility, gets away from the towing locomotives and, breaking through the chain, rams the first gate, there is a second gate, fifty feet away, protecting the lock, which is certain to arrest further advance. When the leaves of this gate swing open, the vessel is towed in, and the gate is closed behind it. Then, from openings placed at

regular intervals in the lock floor, water pours in, lifting the vessel to the level of the lock above. This inflow, coming equally from all points, does not move the ship from a stable position. The gates are never opened or closed with a head of water on either side of them. The process of lifting is repeated until the vessel reaches

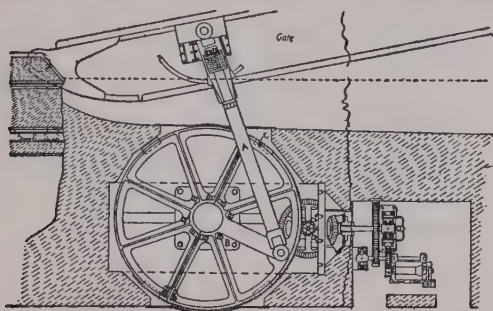


Diagram of lock-gate-operating machine, showing relation of bull-wheel to strut and gate

A, Strut or connecting-rod. *B*, Bed-plate. *C*, Bearing-wheel

the lake level. At all times the vessel is in full view of the men who are controlling it and as safe as if tied to a wharf.

A simple and powerful machine is used for opening and closing the lock gates; it was invented by Edward Schildhauer, an electrical and mechanical engineer in the employ of the canal commission, who describes it as follows:

It consists essentially of a crank gear, to which is fastened one end of a strut or connecting rod, the other end of which is fastened to a lock gate. The wheel moves through an arc of 197 degrees, closes or opens the gate leaf, according to the direction in which it is

turned. One operation takes 2 minutes. The crank gear is a combination of gear and crank, is constructed of cast steel, is 19 feet 2 inches in diameter, and weighs approximately 35,000 pounds. It is mounted in a horizontal position on the lock wall; turns on a large center pin, and is supported at the rim in four places by rollers. The center pin is keyed into a heavy casting anchored securely to the concrete. The crank gear has gear teeth on its rim, and is driven through a train of gears and pinions by an electric motor in a contiguous room. The motor is remotely controlled by an operator who is stationed at a center control house near the lower end of the upper locks. A simple pull of a small switch is sufficient to either close or open a 730-ton gate, the operation being perfectly automatic.

It is connected with the lock gate at the top, 17 feet from the pintle, or hinge, by means of a strut anchor. In use it is required to move a floating gate through level and quiet water. It was put to the extreme test of opening and closing the heaviest of the gates as they stood in the waterless locks and met it with perfect success. The massive structures, weighing from 390 to 730 tons, were opened and closed as easily and steadily as one would open an ordinary door, and each movement occupied less than two minutes.

In addition to the fender chains and double gates, other protective devices are provided. The most elaborate of these is a ponderous-looking structure called the emergency dam. In repose on the walls at each entrance to the upper locks it resembles an iron railway bridge. It is in fact a steel truss-bridge of the cantilever type. It is so placed that it can, in emer-

gency, be swung across the lock entrance in two minutes. If such an extreme improbability should occur as the carrying away of the fender chain and the double gates of an upper lock, allowing the waters of the lake to rush in and flood the lower locks, carrying destruction through them, the emergency dam can be swung across the channel, and through the application of its ingenious devices the rush of water can gradually be checked. First, a series of wicket girders will be lowered into the channel, and their ends will drop into iron pockets in the concrete lock floor. Down the runways in these girders steel plates will be lowered one by one, in tiers, building a dam from the bottom upward and diminishing progressively the flow of water until a complete barrier is erected.

For examining, cleaning, painting, and repairing the lower guard gates of the locks and the Stoney gates of the spillway dam, and for access in the dry to the sills of the emergency dams, floating caisson gates of the moulded ship type are provided. When their use is required they will be towed into position in the forebay of the upper lock above the emergency dam, or between the piers of the spillway, and sunk. The caissons are equipped with electric motor-driven pumps for use in pumping them out and for unwatering the locks.

The question is raised frequently as to the sufficiency of the Gatun Lake water supply for the operation of the canal in case of an exceptionally small rainfall. It should be borne in mind that during eight or nine months of the year the lake will be kept constantly full by the prevailing rains, and consequently a sur-

plus will need to be stored for only three or four months of the dry season. The smallest run-off of water in the basin during the past twenty-two years, as measured at Gatun, was that of the fiscal year 1912, which was about 132 billion cubic feet. Previous to that year the smallest run-off of record was 146 billion cubic feet. In 1910 the run-off was 360 billion cubic feet, or a sufficient quantity to fill the lake one and a half times.

The low record of 1912 is of interest as showing the effect which a similar dry season, occurring after the opening of the canal, would have upon its capacity for navigation. Assuming that the Gatun Lake was at elevation plus 87 at the beginning of the dry season, on December 1, and that the hydro-electric plant at the Gatun spillway was in continuous operation, and that 48 lockages a day were being made, the elevation of the lake would be reduced to its lowest point, plus 79.5, on May 7, at the close of the dry season, after which it would continuously rise. With the water at plus 79 in Gatun Lake there would be 39 feet of water in Culebra Cut, which would be ample for navigation. The water surface of the lake will be maintained during the rainy season at 87 feet above sea-level, making the minimum depth in the canal 47 feet. As navigation can be carried on with about 39 feet of water, there will be stored for the dry season surplus over 7 feet of water. Making the allowance for evaporation, seepage, leakage at the gates, and power consumption, this would be ample for 41 passages daily through the locks using them at full length, or about 58 lockages a day when partial length is used, as would be usually the case,

and when cross-filling from one lock to the other through the central wall is employed. This would be a larger number of lockages than would be possible in a single day. The average number of lockages through the Sault Ste. Marie Canal on the American side was 39 per day in the season of navigation of 1910, which was about eight months long. The average number of ships passed was about $1\frac{1}{2}$ per lockage. The freight carried was about 26,000,000 tons. The Suez Canal passed about 12 vessels per day, with a total tonnage for the same year of 16,582,000.

CHAPTER V

ELECTRIC CONTROL OF LOCK MACHINERY

ONE man in a building on the top of the centre wall of the locks, so placed as to command an unobstructed view of every part of the locks, directs and controls every operation in the passage of a vessel except the movement of the towing locomotives. He has before him on a table a control board about sixty-four feet long and five and one-third feet wide, at the Gatun locks, which is a complete model of the flight of locks in duplicate with switches and indicators in the same relative positions as the machines which they control occupy in the lock walls. Standing before this board the operator throws the switches, and in response to his action he sees on the model the fender chains rise and fall, the gates open and close inch by inch, the water rise or fall in the locks, and knows the exact position of the vessel at every stage of its progress.

Each gate, each valve for letting in the water to the culverts, each fender chain, is operated by a separate motor mounted near the machinery in chambers in the lock wall. In each machinery chamber there is a starting panel containing contractors by which current is applied to the motor, and these panels in turn are controlled from a main unit in the central control-house.

Some of the machinery chambers at Gatun are 2,700 feet distant from the point of control, 90 per cent of them are within 2,000 feet, and 50 per cent within 1,200 feet.

The control system for Gatun locks is typical of all. Water is let into the lock chambers or withdrawn from them by means of culverts under the lock floors, which connect with larger culverts in the lock walls, through which water is carried from the higher to the lower levels. The main supply culverts are eighteen feet in diameter, and the flow of water through them is controlled by rising-stem gate-valves, which can be completely opened or closed in one minute. In the centre wall the culvert feeds both lock chambers, and therefore at each outlet into the lateral culverts there is a valve of the cylindrical type in order that water may be let into or withdrawn from either chamber at will. A complete opening or closing of these cylindrical valves takes ten seconds. The mitre-gates are never opened or closed with a head of water on either side of them, the chambers being first emptied or filled by means of the valve and culvert system. The time required either to open or close the mitre-gates is two minutes.

A ship to be raised to the lake level comes to a full stop in the forebay of the lower lock, prepared to be towed through one of the duplicate locks by electric locomotives. The water in the lower lock chamber is equalized with the sea-level channel, after which the mitre-gates are opened, the fender chain lowered and the vessel passed into the first chamber, where the water is at sea-level. Then the mitre-gates are closed.

The rising-stem gate-valves at the outlet of the main culverts are closed, while those above are opened, allowing water to flow from the lock above into the lower chamber, which when filled raises the vessel twenty-eight and one-third feet, to the second level. This operation is repeated in the middle and upper locks until the ship has been raised to the full height of eighty-five feet above the level of the sea. At Gatun in the passing of a large ship through the locks it is necessary to lower four fender chains, operate six pairs of mitre-gates, and force them to mitre, open and close eight pairs of rising-stem gate-valves for the main supply culverts, and thirty cylindrical valves. In all, no less than eighty-two motors are set in motion twice during each lockage of a single ship, and this number may be increased to one hundred and sixty-three, dependent upon the previous condition of the gates, valves, and other devices.

The system is interlocking, so that certain motors cannot be started in a particular direction until other motors are operated in a proper manner to obtain consistent operation on the whole, and to avoid any undesirable or dangerous combinations in the positions of valves, gates, or fender chains. In this way and by the use of limit switches the factor of the personal equation in operating the machines is reduced to a minimum, almost mechanical accuracy being obtained. Before the operating pair of valves in the main culverts can be opened, at least one pair of valves at the other ends of the locks, both up-stream and down-stream, must first be closed. This limits an operator to the act of

equalizing water levels between locks, and keeps him from allowing water to flow from, say, the lake level to the middle lock past the upper lock, thus preventing a possible flooding of the lock walls and machinery rooms. Interlocks, devoted to the control of action between the gate-valves in the main culverts and the mitre-gates, prevent valves being opened a lock length above or below a mitre-gate which is being opened or closed, and thus prevent an operator causing a flow of water while the mitre-gates are being moved. Interlocks for the cylindrical valves guarding the openings from the centre-wall culvert to the lateral culverts keep those of one side or the other closed at all times, except when it may be desired to cross-fill the chambers, when they may be opened by special procedure. An interlock prevents the operator from starting to open a mitre-gate before unlocking the mitre-forcing machine. The mitre-gates guarded by a fender chain must be opened before the chain can be lowered, and the chain must be raised again before the gate can be closed, or, more exactly, the switches must be thrown in this order, but the operations may proceed at the same time. The simple interlocks will prevent such a mistake as leaving the chain down through lapse of memory, when it should be up to protect the gate.

CHAPTER VI

LIGHTING SYSTEM

THE canal is lighted from end to end by electricity and gas. Here and there along its course, high up on the hillsides and in cleared spots in the jungle, are visible concrete lighthouses which seem curiously out of place. These are for the range-lights of the channel, which are used in all sections of the canal save in Culebra Cut, where beacons are substituted as being more practicable. Electricity is used wherever accessibility will permit, but in the floating buoys which mark the channel through Gatun Lake, and in towers and beacons in inaccessible places, compressed acetylene, dissolved in acetone, is used. The candle-power of the range-lights varies according to the length of the range, from about 2,500 to 15,000. The most powerful lights are those marking the sea channels at the Atlantic and Pacific entrances, they being visible for from about 12 to 18 nautical miles. The beacons and gas-buoy lights have about 850 candle-power. White lights are used throughout, and in order to eliminate the possibility of confusing the lights with one another and with the lights on shore, all range-lights, beacons, and buoys have individual characteristics, formed by flashes and combinations of flashes of light and dark intervals.

Satisfactory lighting of the locks was a difficult problem. The end sought was an illumination that would approach sunlight distribution as nearly as possible, causing the least inconvenience to the eye. As vessels are to pass through the locks at night, it is necessary that the lock walls and chambers be brightly illuminated, while at the same time it is no less necessary that the brilliant sources of illumination be shaded from the eye of an approaching pilot, in order that he may have unhampered vision of all range and signal lights. The eye can untiringly accommodate itself, with excellent vision, to a very low intensity of illumination, such as moonlight, provided there exists no random interference of a relatively intense brilliancy. Any bright spot, however, renders vision indistinct, difficult, and fatiguing.

In the selection of exterior lamp units, a thorough investigation was made of different types of lamps and reflectors, and tests were conducted at Gatun locks to determine the general characteristics and suitability of certain promising lamp and reflector units.

The type finally selected is a large-power tungsten bulb (500 watt) placed inside a concrete hood, which serves both as a shade and as a reflector. The area to be illuminated extends three hundred feet back of the lock chamber, calling for two types of lamp standards—single-bracket and double-bracket. The single-bracket standards are used on the centre wall, where the lamps are staggered so as to illuminate both lock chambers. The double-bracket is used on the side wall, where it is desired to throw the lighting flux for a

considerable distance back of the lock chamber. The reflecting hood is provided with shading skirts, which prevent the glare of the lamp filament from penetrating into distance along the axis of the canal. The direct rays of light are cut off on the coping level at approximately forty-one feet from the centre of the post.

Clustered under the concrete hoods, the lamps are suspended from brackets which are placed near the tops of heavy concrete columns, twelve-sided and tapering from $3\frac{1}{2}$ feet at the base to one foot at the top. The columns are capped with balls of concrete 2 feet in diameter, making their total height about 34 feet. They are aligned longitudinally and transversely, alternate lamps being spaced on from 50- to 60-foot centres. Both the pedestal and column contain a large core, serving the double purpose of reducing the weight and of furnishing a runway for the electric wires. About $3\frac{1}{2}$ yards of concrete and 750 pounds of steel reinforcement were required in the construction of each standard, of which there is a total of 511—211 at Gatun, 131 at Pedro Miguel, and 169 at Miraflores.

Electrically, the lamps are connected alternately upon separate circuits, providing thereby a duplication of wiring, as well as a means of economical operation whenever half-illumination only may be required on bright moonlight nights. Arrangement is made in the wiring so that all the lamp circuits are remotely controlled by the attendant in the control-house—the operating centre for all the lock machinery and indicating apparatus.

Each lamp standard is provided with a special out-

let box, located in the concrete pedestal. The outlet box is to permit the insertion of plugs to connect a portable lamp circuit and a portable telephone circuit. A portable lamp may be required at any moment in the operation of the locks to place light at an electric locomotive or on the deck of a passing vessel. A portable telephone is to permit a supervisor of lockages to communicate with the central control-house from any position on the lock walls. The outlet is placed in the pedestal of the lamp standard merely as a matter of operating convenience during lockages, the standards being accessible through the entire length of the lock walls.

Concrete reflectors are used also below the surface of the lock walls, in the operating-tunnels and machine-rooms. The tunnel which connects the various machine-rooms and operating centres is seven feet in height, the floor being eight feet below the coping level. It is lighted normally during daylight hours through deck-lights located in the ceiling. For illumination at night and on dark days, small sixteen-candle-power carbon-filament lamps (or twenty-five-watt tungstens) are set in recesses in the ceiling, the lamps alternating with the deck-lights. A special reflector cast from concrete is used. It is so designed that a proper diffusion of the light along the operating-tunnel is accomplished without a severe glare striking the eye. There will be a total of approximately 2,025 tunnel and machine-room reflectors—950 at Gatun, 675 at Miraflores, and 400 at Pedro Miguel.

CHAPTER VII

THE APPROACH CHANNELS

As stated in a previous chapter, the approach channels in the two oceans have a common width of 500 feet. That on the Atlantic side has a depth of 41 feet at mean sea-level, and that on the Pacific 45 feet. Their combined length is $15\frac{1}{2}$ miles, so that nearly one-third of the entire canal is at sea-level. The total excavation for the Atlantic entrance was about 39,000,000 cubic yards, and for the Pacific entrance, including about 7,000,000 cubic yards for the Balboa terminal basin and docks, was about 48,000,000. Work was begun in both entrances in June, 1907.

The French did a large amount of work in both oceans, but only a small portion of it was of use to the American canal because of changes in the location of the entrance channels. At the Atlantic end the change was complete, and while the French canal between Colon and Gatun was useful for a time in transporting material for lock construction, only about 182,000 cubic yards of French excavation were of permanent value. At the Pacific end the location of the entrance channel from Balboa out into Panama Bay was changed from the French line, but about 3,250,000 cubic yards of their excavation were useful.

The French dredged a canal from Colon to Bohio, all of which, except the section below Gatun, has disappeared beneath the waters of Gatun Lake. In point of efficiency their dredging equipment approached more nearly to the modern standard than their dry excavation plant. They had in service 37 dredges of various makes—Scotch, Holland, Belgian, and American. Most of these were chain-bucket or ladder dredges capable of excavating to a depth of from 34 to 41 feet. Each chain had from 28 to 31 buckets, each with a capacity of $4\frac{1}{2}$ cubic feet. The material was emptied through a side chute into barges, or sluiced through pipes 164 feet long to the banks on either side. Three of them were sea-going dredges with larger buckets. The French had also five suction dredges, forerunners of the modern dredge of that type, but they were not a success.

When the Americans took control they found several of the ladder dredges in fairly good condition, and they repaired seven of them* and used them during the entire period of construction. They were extremely well built and did excellent service according to their size and capacity, but it is a question with the American dredging engineers whether the money spent in rehabilitating them was good economy in the long run—that is, whether it would not have been a better investment to discard them and buy new and more powerful modern dredges of similar type.

A modern dredge of the ladder type, the *Corozal*, was made to order for the commission at Renfrew, Scotland, and arrived at Panama under its own steam on

*See Chap. XXIV, Part IV.

March 27, 1912. Its engines have a total of 1,893 horse-power; its chain carries 39 buckets, those for soft excavation having a capacity of 54 cubic feet, and those for hard material 35 cubic feet. It can excavate to a depth of 50 feet. Compared with the sea-going French dredge of the same type, the *Corozal* has buckets of five times the capacity, can excavate 10 feet deeper, and can dump either into a barge or into its own bins. Its full capacity, working under favorable conditions, is ten times that of a French dredge of the same type. Its average output is easily 20,000 cubic yards in a 24-hour day. Its buckets cut into soft rock, which has not been blasted, and remove it with ease.

Most of the excavation in the approach channels in both oceans was done by two powerful sea-going suction dredges, each with an average capacity of about 22,000 cubic yards in a 24-hour day. These dredges are built like ocean steamships, which in outward appearance they resemble, and their crews, numbering about 60 men, eat and sleep on board, working in shifts day and night throughout the week, resting only on Sundays. There were no dredges in the French equipment at all comparable to these. In all the Americans had in service during the period of construction 20 dredges of varying capacities.*

An additional equipment for use in emergency work in the Culebra Cut and permanent work after the canal is in operation was ordered by the canal commission in February, 1913, and will be delivered at the

* See Appendix D.

close of 1913 and the beginning of 1914. This includes two dipper dredges with dippers of 10-cubic-yard capacity for use in rock, and others of 15-cubic-yard capacity for use in earth. For service in connection with them six dump barges, each with a capacity of 1,000 yards, have also been ordered.

Long breakwaters have been constructed near the approach channels in both oceans. One in Limon Bay or Colon harbor, called the West Breakwater, extends into the bay from Toro Point at an angle of $42^{\circ} 53'$ northward from a base-line drawn from Toro Point to Colon light, and is 11,526 feet in length, with a width at the top of 15 feet and a height above mean sea-level of 10 feet. The width at the bottom varies with the depth of water. It will contain approximately 2,840,000 cubic yards of rock, the core being formed of rock quarried on the mainland near Toro Point, armored with hard rock from Porto Bello. Work began on the breakwater in August, 1910.

A second construction, known as the East Breakwater, is to be made. It will be without land connection, about one mile in length and will run in an easterly direction at nearly a right angle with the canal channel. It will be so placed that the opening between its end and that of the West Breakwater will be 2,000 feet—that is, the end of each breakwater will be 1,000 feet away from the centre of the channel. The purpose of the West Breakwater is to protect the harbor against “northers,” very severe gales which are likely to blow from October to January. The purpose of the East Breakwater is to prevent silting in the canal channel,

which has been found to be very heavy. The cost of the West Breakwater is about \$7,500,000 and of the East is estimated at about \$4,000,000.

The breakwater at the Pacific entrance extends from Balboa to Naos Island, a distance of about 17,000 feet, or a little more than three miles. It lies from 900 to 2,700 feet east of, and for the greater part of the distance nearly parallel to, the axis of the canal prism, varies from 20 to 40 feet in height above mean sea-level, and is from 50 to 3,000 feet wide at the top. It contains about 18,000,000 cubic yards of earth and rock, all of which was brought from Culebra Cut. It was constructed for a twofold purpose: first, to divert cross-currents that would carry soft material from the shallow harbor of Panama into the canal channel; second, to furnish rail connection between the islands and the mainland. A railway track and a driveway will be constructed on the top for the entire distance between Balboa and Naos Island. Work was begun on it in May, 1908, and on November 6, 1912, the last piles were driven connecting Naos Island with the mainland.

Dredging operations at the Atlantic entrance were under the direction of F. B. Maltby from the beginning of American work until April, 1907, when, together with those at the Pacific entrance, they passed under the direction of Major D. D. Gaillard, head of the Department of Excavation and Dredging. In July, 1908, when the new organization of the work into three great divisions—Atlantic, Central, and Pacific—went into effect, dredging at the Atlantic entrance passed under



Breakwater at the Pacific entrance, extending to Naos Island, with Balboa Dump in the foreground, upon which the camp of the Coast Artillery is to be placed.

the direction of Colonel Sibert, and that at the Pacific entrance under the direction of S. B. Williamson. In immediate charge, under Colonel Sibert, of dredging at the Atlantic entrance was Major Edgar Jadwin, as resident engineer, who held the position till June 15, 1911, when he was succeeded by Major Chester Harding, who held it till February 27, 1913.

On the Pacific side W. G. Comber, who as resident engineer was in charge of dredging under Mr. Maltby in the Atlantic entrance from August 14, 1905, till February 1, 1907, when he was transferred to the Pacific entrance, was continued in charge as resident engineer under Mr. Williamson. On May 1, 1913, Mr. Comber, by order of the chairman and chief engineer, was placed in charge of all dredging operations on the isthmus.

CHAPTER VIII

PERMANENT CANAL BUILDINGS

THE simple wooden buildings in which the canal force was housed during the period of construction were designed and erected with the expectation that they would withstand the effects of the climate for ten or twelve years. Under constant watchfulness and care they have met this expectation, but without those safeguards they would not have lasted more than half as long. Their most destructive enemy, next to the rotting effects of the damp climate, is the isthmus ant, almost infinite in variety, illimitable in numbers, and untiring and really diabolical in activity.

Left at the mercy of this enemy, working in unison with the dampness of the climate, a wooden house has a very poor chance for more than a few years of existence. The temporary commission buildings were saved from rapid deterioration and decay by incessant watchfulness, prompt repair, and unceasing warfare upon ants. Large sums were spent each year for these purposes, and by means of them the buildings as a whole were in such good condition when the task neared completion that they might have been kept in use for several years longer. Many of them, in those settlements that were not on the abandoned side of the canal, in-

cluding the towns at both entrances and Gatun, Pedro Miguel, and Corozal, will be kept in use till they are replaced by permanent structures of concrete.

Whole towns, containing populations varying from a few hundred up to seven thousand, have either vanished from sight or will disappear within a year. Their buildings will either be demolished or taken apart, transported to the sites of permanent towns, and put together again for temporary use, either by the civilian force of the canal or by the military contingent. This change can be made at a cost of about one-third of the first cost of the buildings. In the original erection of them and in repairs the commission expended over \$10,250,000.

All permanent buildings will be of concrete, both for civil and military uses. For the administrative and operating force of the canal a group of buildings will be erected on a site between Ancon and Sosa Hills. The main structure will be the administration, or canal headquarters, building. This will stand on a knoll, about seventy-five feet above the plain below, on which the other buildings will be arranged, commanding a fine view of the Pacific entrance and terminal piers. It was designed by Austin W. Lord, of New York, and is classic in style. It will be three stories in height, with a frontage of about 327 feet and a depth at the wing ends of 182 feet. It will be constructed of concrete blocks about a steel framework, and the surface of the blocks will be covered with cement stucco. Its roof will be covered with dark-red vitreous tiles. There will be a square pier colonnade along the front and end

elevations, rising from the first-floor level to the second-floor ceiling, protecting the building against sun and rain. The principal entrance, facing Sosa Hill, will be enclosed by massive end bays and pylons, and will be reached by a grand flight of steps and ramps from the plain below. The rear of the building, with its central wing and two end wings, will enclose a large court, treated as a patio, which will serve as carriage entrance to the building, with a porte-cochère at the central wing.

The three floors will be divided into office-rooms, about a central rotunda 43 feet in diameter. The entire floor area will be 67,000 square feet, in addition to the space occupied by halls, stairways, elevators, toilets, etc. The basement, with an area of 20,000 square feet, will be used as a storage vault for canal archives. The total building area at the grade line is 23,000 square feet. The total cost is not to exceed \$375,000. Work on the site began in February, 1913.

On the plain lying seventy-five feet below the site of the administration building, a town site for other permanent buildings has been planned. This plain was formerly a swamp, and was raised to an elevation twenty feet above sea-level by material from Culebra Cut and by hydraulic fill from the excavation for the terminal structures at Balboa. On this will be erected quarters of different types for employes, accommodating one, two, and four families each; a police-station; post-office; chief sanitary office; fire-station; dispensary; telephone building; club-house; hotel; lodge hall; church; commissary; and schoolhouse. All these struc-

tures will be ranged on either side of a central avenue, extending on a direct axis from the approach to the administration building through the town site, and terminating in a grove of mango-trees at the foot of Sosa Hill. All buildings will be of concrete blocks, and of the same general style of architecture as the administration building. They will be connected with one another by a continuous arcade, which will serve as protection against sun and rain. There will be included in the plan a baseball-field, tennis-courts, and a band-stand.

Permanent structures, also of concrete blocks, will be erected for the marine contingent and for the military force with a minimum strength of 7,000 men. It is proposed to place the marine camp on Ancon Hill, on the elevated plateau in front of the quarry which has been used to obtain crushed stone for the concrete in the Pacific locks. This site overlooks that of the administration building, and is second in attractiveness and beauty of prospect to no other within the Canal Zone. It is estimated that \$400,000 will be necessary to construct barracks for 500 marines. The camp will be used as an advance post by the Navy Department, and the marines quartered there will not be considered as part of the defence force of the canal.

It is proposed to erect on the filled area in Panama Bay, known as the Balboa Dump, quarters for 8 companies of coast artillery, 872 men, at an estimated cost of \$536,000; on Culebra Island an outpost guard building, at an estimated cost of \$40,000; on Toro Point quarters for two companies, at an estimated

cost of \$200,000; and for a like force at Margarita Island at the same estimated cost; making the total expenditure for the coast artillery barracks \$976,000.

The site for the camp for mobile troops in the interior of the Canal Zone has not been decided finally. Two locations are under consideration, one on the high ground on the east side of Culebra Cut, north of Gold Hill, and the other on the filled ground near Miraflores. In one or the other of these locations barracks will be constructed of concrete blocks for three regiments of infantry, one squadron of cavalry, and one battalion of field (mountain) artillery, at an estimated cost of about \$4,000,000.

There will be permanent settlements of concrete construction, ultimately, at Pedro Miguel for employes of the Pacific locks, and at Gatun for employes of the Atlantic locks.

CHAPTER IX

TERMINAL FACILITIES, DRY-DOCKS, AND REPAIR-SHOPS

THE terminals of the canal in both oceans will be equipped with such facilities as will make them most serviceable to the military and naval needs of the United States and most attractive to the shipping of the world. There are under construction at both entrances systems of concrete piers with a length of not less than 1,000 feet, a width of 200 feet, and slips 300 feet wide between them. Dock and wharf construction is of permanent character, either of reinforced concrete or steel protected by concrete. The dock-sheds will have steel frames suitably protected against corrosion, and a roof covering either of concrete or of other material capable of resisting indefinitely climatic effects. In addition to berthing space for large vessels, the piers will be provided with ample landing room for launches and smaller boats.

The docks will be provided with standard-gauge railroad tracks for the convenient handling of cargo. Each dock-shed will be provided along each side with a longitudinal steel girder to which blocks and lines may be attached to assist in the handling of cargo. The depth of water alongside the Cristobal docks will be 41 feet, and alongside the Balboa docks 45 feet above

mean sea-level, the increased depth at the latter being necessary because of the extreme tidal oscillation in the Bay of Panama.

At Balboa there will be a length of 2,200 feet of uncovered docks immediately in front of the repair-shops, which in time of peace will be available for commercial use. In time of war it will be available for berthing vessels requiring repairs. The Balboa piers will be at right angles with the axis of the canal channel, with their ends about 2,650 feet away from it.

Only one pier will be built at first at either terminal. If later the commercial requirements of the canal demand them, four others will be added. The pier at Cristobal is behind a mole and breakwater extending 3,085 feet from the shore-line and paralleling the boundary-line between Canal Zone and Panama waters. The wharves on both sides will not be equipped with cargo cranes until canal operations show the character and amount of freight that will have to be handled.

The establishment of dry-docks and repair-shops of ample capacities to meet all demands was considered by the fortifications board as a necessary part of the scheme of national defence. Such action was considered by the canal commission also to be a necessary part of the operation of the canal. An agreement was reached to place both dry-docks and repair-shops at the Pacific terminal, since the chief demand for them would be at that point. The dry-docks, excavation for which began in January, 1913, are situated behind Sosa Hill, at Balboa, and the repair-shops will be near by on the site of the old marine repair-shop of the



First of the permanent docks at Cristobal. Vessels of the Atlantic Squadron, U. S. N., first to make landing, January 14, 1913. Officers and men taking observation train to see canal.



Letting the Pacific Ocean into the canal, May 18, 1913. Sixteen tons of dynamite were used in the explosion which destroyed the dike.

French company. The main dry-dock will be capable of accommodating any vessel that can pass through the canal locks. It will have a usable length of 1,000 feet, a depth over the keel blocks of 35 feet at mean sea-level, and an entrance width of 110 feet. The entrance will be closed by mitre-gates similar to those used in the locks. The dry-dock will have a rock foundation, and its sides will be lined with concrete. Its equipment will include a forty-ton locomotive crane, with a travel on both sides.

For vessels of smaller type, an auxiliary dry-dock will be built near the main one, in lieu of the marine railways originally contemplated. It will have a usable length of 350 feet, a width of 80 feet, and a depth over the keel blocks of $13\frac{1}{2}$ feet at mean sea-level. It will be provided with a floating caisson. The forty-ton locomotive crane and the pumping plant on the main dry-dock will be utilized for this dock also. The work of providing space for these dry-docks, as well as for the new shops, required the excavation of about 300,000 cubic yards of material from the northwest face of Sosa Hill. The excavated material was used in filling the site for the shops and terminal yard.

On the Atlantic side, where it is thought only limited repair facilities will be required, it is proposed to retain the old French dry-dock at Mount Hope, which has a usable length of 300 feet, a width at entrance of 50 feet, and a depth over the sill of 13 feet at mean sea-level. It was the opinion of the board in charge of the dock projects that the commercial requirements in sight would not warrant the construction of a dry-

dock at Cristobal capable of accommodating large vessels, in view of the building of a dry-dock at Balboa, to which any large vessel on the Atlantic side could be taken and returned in case it was found necessary to dock it for repairs.

Both dry-docks and repair-shops have been placed so as to secure protection against naval bombardment, and at the same time give vessels convenient access to the shop water-front. With these ends in view, the dry-docks have been located on a rocky ledge forming the base of Sosa Hill, and the main repair-shops in an area 600 feet wide, between the dry-dock and the repair wharf. The shop buildings are of steel frame, open on the sides for ventilation and light, with a reinforced concrete tile roof, and fully equipped for convenient and economical handling with overhead electric travelling cranes. The shop equipment includes a two-story fire-proof storehouse, 400 feet by 120 feet, for general supplies required in the manufacturing and repair work. Installed in the shops will be all of the machinery, tools, etc., used during canal construction which have a permanent value. In addition, new tools will be installed, especially adapted for large marine work. Tools will be driven by electric motors, individual motors being provided for special tools, and group drives being adapted where practicable. These shops are intended to handle all the repair work for the canal equipment as well as for the Panama Railroad, all commercial work, and all naval work.

For the handling of the lock-gate leaves, as well as for other canal requirements and commercial and gen-

eral wrecking purposes, two powerful floating cranes of two hundred and fifty gross tons capacity have been ordered of a manufacturing firm in Germany, and they will be delivered about January 1, 1915.

For handling vessels of the largest size at Cristobal and Balboa two high-power harbor tugs will be provided, and for the transportation of coal, fuel oil, and fresh water alongside of vessels a sufficient number of barges and lighters will be placed in service. Steel barges, now in use by the canal commission, after the necessary modifications have been made, will be placed in the barge and lighter service. A tender for passengers and mail will be furnished at each terminus also, provided the business justifies it.

CHAPTER X

FOOD, COAL, OIL, AND OTHER SUPPLIES

IN addition to the terminal facilities described in the foregoing chapter the United States Government has decreed that all vessels passing through the canal shall have the opportunity to purchase at reasonable and stated prices all supplies that they may need, cold storage and general articles of food, coal and oil for fuel and other purposes, fresh water, or anything else held in stock by the government for the supply of its canal, naval, and military forces. For the first time in its history the United States Government will go into commercial business.

The main object is to attract shipping to the canal by holding out inducements to use it. If the owners of vessels desiring to pass through it can be assured that they can obtain at Panama and Colon supplies of all kinds, and get all necessary repairs made, at moderate prices, completely safeguarding them against extortion in all respects, the advantages of the route will be greatly enhanced. Vessels making long voyages can cut their coal-bunker space in half, and also their cold-storage and food-supply spaces, gaining thereby more room for freight.

While it was a new departure for the United States

Government to go into the public supply business, the step was a logical one. In constructing the canal it had been engaged in that business on its own account for ten years or more. It had, in order to feed its army of employes, erected a large cold-storage plant, a central commissary or great department store, with a line of branch stores, a bakery and laundry and other necessary agencies. These were used, not only to meet the wants of its employes, but of marine and military camps, and of visiting naval vessels. It was obliged to keep on hand supplies of coal for naval vessels as well as for its own work.

With the opening of the canal to traffic, the demand for supplies for government purposes will continue and must be met. The operating force of the canal, estimated at 1,500 men; the military contingent, with a minimum force of 7,000 men; the marine force of 1,500 men, and the operating force of the Panama Railroad must be fed and otherwise cared for. The coal supply for the navy must be greatly increased, and a fuel-oil supply provided. By including all persons in need of food and other necessities in a single body, to be supplied from a central plant, a great saving in operating expenses is effected, and consequently in the cost of supplies to the "ultimate consumer." The central commissary, with its laundry, bakery, etc., makes unnecessary separate establishments of the kind in the military and marine camps, and thereby saves the government money.

To extend all these privileges to the vessels of all nations passing through the canal includes them in the

benefits conferred and makes the Panama route both an economical and an attractive one, and thereby aids it in its direct competition with the Suez Canal.

It is the policy of the United States Government to keep complete control of the terminals, water-frontage, and transportation by land and water across the isthmus, and to this end no land, nor land under water, near the terminals that may later be needed by the United States will be leased. It is not the policy to attempt to monopolize the fuel business, and every means has been taken to encourage the establishment of private coal and oil depots on the isthmus under proper conditions. The duplication of plants for private coal and oil stations is undesirable, and therefore the government plants are being so laid out as to afford ample wharf room, and to provide modern coal handling machinery for unloading colliers into the coal pile and reloading coal to lighters or barges.

The Navy Department requires that there be kept at all times on the isthmus 100,000 tons of coal at the Atlantic terminus, and 50,000 tons at the Pacific terminus. This supply could not be maintained at a reasonable price through individuals or companies. The government must be its own purchaser. As a storage basis for this supply a basin will be constructed at Cristobal with a capacity of 290,000 tons, and one at Balboa with a capacity of 160,000 tons. In each place the basin will be made of reinforced concrete, in which approximately half of the coal will be stored under water for use in time of war, and the other half above water, to be added to and taken from continually

for the ordinary uses of commercial and government vessels. It is also planned to lease parts of the storage basins to such private coaling companies as may wish to maintain their own coal stores on the isthmus; but in such cases all of the handling will be done by the government plant, a suitable charge being made for the service.

The coaling plant at the Atlantic entrance will be situated on the north end of the island formed by the old French canal, the American canal, and the Mindi River. It will be reached from the mainland by means of a bridge to be built by the Panama Railroad over the French canal south of the dry-dock shops. The storage basin will be opposite Dock No. 13, at Mount Hope, and it will be 1,000 feet long and 250 feet wide. The bottom of the basin will be 19 feet below mean tide, and the elevation of the decks of the wharves 10 feet above mean tide. There will be 41 feet depth of water alongside the wharves. The wharves will be founded upon steel cylinders filled with reinforced concrete, resting upon hard rock. The maximum tidal oscillation in Limon Bay is 2.65 feet.

For this type of storage basin, at least two layouts of coaling plant are feasible; the first being that in which the loading and unloading wharves occupy opposite sides of the basin parallel with one another, with the coal piles between them, and the second that in which the unloading wharf will be at right angles to the loading wharf. The normal capacity will be 240,000 tons, capable of increase to 290,000 tons by piling coal to 10 feet above normal height.

The coaling plant at the Pacific entrance will be on the quay wall south of the entrance to the large dry-dock. The size of the basin will be 500 feet long and 250 feet wide for one design of plant, and the same length and 340 feet wide for a second design. The extreme tidal difference here is 21.8 feet. As at the Atlantic entrance, the loading wharf will be founded upon concrete cylinders resting upon hard rock; the unloading wharf will be gravity section concrete wall resting on rock. The normal capacity of the Balboa plant will be 135,000 tons, capable of increase to 160,000 tons by piling coal 10 feet above normal height.

The layout is somewhat different from that at the Atlantic entrance, although the methods of handling the coal will be similar. The unloading wharf will be situated at the outer end of the dry-dock slip, while the line of the loading wharf makes an angle of about forty-five degrees with that of the unloading wharf, running out toward the canal prism from the end of the unloading wharf.

A certain ground area will be set aside for the storage of coal by individuals or companies, and this area will be served by the government handling machinery with the same effectiveness as coal in the government storage basin.

This arrangement will obviate the necessity of any dredging, wharf construction, or purchase of coal-handling machinery by private owners and companies, and at the same time will enable them to obtain the benefits of the rapid coal-handling machinery to be purchased by the United States. The cost of taking

coal in and out of storage, and of the wharfage facilities and dredging thus availed of, will be apportioned at a reasonable price per ton to all individuals and companies alike on an equitable basis. For the area to be occupied by the coal pile a rental charge based upon the cost of fitting up the area for private coal storage will be charged in addition. Assurance of satisfactory service can be given by the canal authorities. It is expected that the government coaling plant will be in operation before January 1, 1915. Suitable temporary arrangements will be made to take care of any business originating before the permanent plant is completed. Such a permanent plant will require no outlay for improvements on the part of individuals and companies, and will enable them to participate in the coal business on what appear to be more advantageous terms than if they should each proceed with the construction and installation of their own docks and coal piles and coal-handling machinery.

Similar facilities will be provided for furnishing vessels with fuel oil. Two large oil tanks will be installed at each end of the canal. By the time the canal is ready for operation the United States will have an oil pipe line across the isthmus with the necessary pumping plants, and dock space will be provided at each end of the canal for vessels to deliver or receive fuel oil. Pumps of suitable capacity will also be provided to pump oil from the water-front to tanks in the vicinity or at points along the canal line. Individuals and companies desiring to enter this business can make application for revocable licenses covering the plats

of ground more or less removed from the water-front which can be assigned for the erection of oil tanks. Under the Taft agreement with Panama, coal and oil for fuel for canal use and for supplying vessels using the canal may enter the Canal Zone without the payment of duty to Panama.

The Navy Department is erecting a high-power wireless telegraph station at a point situated about midway of the isthmus. It is near the site of the old town of San Pablo, now underneath Gatun Lake.

The site is from sixty to one hundred and ten feet above the normal level of Gatun Lake, accessible by means of the Panama Railroad, and near to the electric transmission and telegraph and telephone lines which will follow the right of way of the railroad. In addition to this high-power station, which will be capable of communicating with points at a distance of three thousand miles, there will be stations of less power at Porto Bello and Colon, where the navy now maintains stations, and one at Balboa, near the Pacific entrance to the canal. The status of wireless telegraph communication on the isthmus has been fixed by the President in accordance with the following recommendation of the joint board of the army and navy appointed for that purpose:

That no private or commercial wireless installations be permitted in the Canal Zone.

That an understanding be reached with Panama to prevent the establishment of private and commercial wireless installations in its territory.

That the Navy Department shall have authority to

install, maintain, and operate under its jurisdiction a high-power wireless station in the Canal Zone, to be used in connection with its other stations in the Atlantic and Pacific, and for controlling the movements of its fleets in waters adjacent to the Panama Canal.

That wireless stations under the jurisdiction of the Navy Department shall be opened to the public service and shall transmit commercial business under such regulations as the President of the United States may prescribe.

CHAPTER XI

FORTIFICATIONS

ALL information in this chapter is derived from the public writings and utterances of various army authorities, including H. L. Stimson, ex-Secretary of War; Major-General Leonard Wood, Chief of Staff; Brigadier-General Bixby, Chief of Engineers; Colonel Rogers Birnie, acting Chief of Ordnance; Brigadier-General E. M. Weaver, Chief of Coast Artillery; Colonel Edward Burr, Assistant to Chief of Engineers, and others. The information derived from the army officers named was given by them in hearings before a subcommittee of the House Committee on Appropriations, in January, 1913, and published as a congressional document.

The defences of the canal will be divided into two general parts: first, the protection by heavy fortifications of the entrances in both oceans; second, by field-works about the locks and a mobile force of troops with a minimum strength of 7,000 men. The fortifications at the Atlantic entrance will be placed on Toro Point, on the west side of Colon Bay, from which the West Breakwater extends for a distance of two miles into the bay, and on Margarita Island, on the east side, which is about one mile north of Colon, is nearly opposite Toro Point, and is outside the two breakwaters.

On the Pacific side the fortifications will be placed on three small islands, Flamenco, Perico, and Naos, lying in the Bay of Panama, about three miles from Balboa, and abreast of the entrance to the canal. The armament of these fortifications will be of more powerful and effective types than those installed in any other locality in the world. On the Atlantic side, on Margarita Island, it will include two 14-inch and two 6-inch guns on Toro Point, two 14-inch, two 6-inch, and eight mortars; and at Manzanilla Point, city of Colon, two 6-inch guns. On the Pacific side it will include one 16-inch gun on Flamenco, the outermost of the three islands; one 14-inch gun each on Perico and Naos islands, two 6-inch guns also on Naos and some 12-inch mortars of a new and powerful type. There will also be at both entrances 6-inch guns and howitzers to protect the forts on the land side and submarines at the entrances.

In regard to the adequacy of the defences the general board of the navy, in a report published in 1912, said:

The General Board believes that the proposed fortifications at the termini of the Isthmian Canal would be invaluable in assisting the transfer of a United States fleet from one ocean to the other, through the canal, in the face of an opposing fleet. The function of the fortifications in this particular is precisely the same at the canal termini as it is at any fortified place from which a fleet may have to issue in the face of an enemy's fleet.

Guns mounted on shore are on an unsinkable and steady platform, and they can be provided with un-

limited protection and accurate range-finding devices. Guns mounted on board ship are on a sinkable, unsteady platform, their protection is limited, and range-finding devices on board ship have a very limited range of accuracy. The shore gun of equal power has thus a great advantage over the ship gun which is universally recognized, and this advantage is increased if the former be mounted on disappearing carriages, as are the sea-coast guns of the United States. The mere statement of these elementary facts is a sufficient proof of the value of seacoast guns to assist a fleet in passing out from behind them to engage a waiting hostile fleet outside, provided the shore guns are mounted in advance of, or abreast, the point where the ship channel joins the open sea. Even if somewhat retired from that point they would be useful, but to a less extent.

At the Pacific terminus of the canal, there are outlying islands that afford sites for fortifications, the usefulness of which in assisting the egress of a fleet in the face of opposition is universally admitted, as far as the General Board knows; but there has been unfavorable criticism of the possibility of fortifications at the Atlantic end to serve this purpose. The General Board regards these criticisms as unfounded and believes, on the contrary, that the conditions at the Atlantic terminus of the canal are unusually favorable for the emplacement of guns that would be of assistance to a fleet issuing in the face of hostile ships.

On both sides of Limon Bay, in which the canal terminates at the Atlantic end, there are excellent sites for forts, well advanced on outlying points. The line joining these sites is 3,000 yards in front of the point where the canal prism reaches a low water depth sufficient for battleships, and Limon Bay from this point outward is wide enough for a formation of eight ships abreast. The outer end of the most advanced

breakwater proposed is only 600 yards in front of the line joining the sites for the forts; and as long as ships remain behind the breakwater, it will afford them a considerable amount of protection from the enemy's fire, while they will themselves be able to fire over it. In order to make his fire effective against the issuing ships the enemy must come within the effective fire of the fortifications. Under these circumstances, it is impossible to deny the usefulness of fortifications in assisting the issue of a fleet against opposition. The conditions in this respect at the Atlantic end of the canal are incomparably better than those existing at Sandy Hook, whose forts nobody would dream of dismantling.

On the same point of the adequacy General Weaver, in his testimony before the subcommittee of the Committee on Appropriations, January 16, 1913, made reply to a criticism that had been raised frequently about the Pacific fortifications.

I think that the defenses are wholly adequate. The only question I have noted raised as to the adequacy of the defense has been as to whether guns would not be mounted by an enemy on Taboga Island, and as to whether an enemy's ship could not stand behind Taboga Island, and as to whether these land guns and naval guns could not from there control the water area in front of the Pacific terminus. The new type of mortars that the Ordnance Department is making for the fortifications at Panama will have a range of 20,000 yards. They will cover the water well over beyond Taboga Island, and have under fire all of Taboga Island and the water for a considerable distance beyond the outermost shore lines of Taboga Island. It is about 12,000 yards from the fortifications at the canal terminus to Taboga Island. The mortars will

reach 8,000 yards beyond Taboga. The 16-inch gun on Flamenco will have a range of 20,000 yards. The 14-inch guns on Perico and Naos Islands will have ranges of 18,400 yards. The 6-inch guns on Naos Island and on the mainland have a range of 6,000 yards, and are well placed to oppose any attempt at landing on the islands on which the fortifications are located.

On the Atlantic side the defense is, in my opinion, equally adequate. At Fort Randolph, on Margarita Island, there are eight mortars of the new type, two 14-inch guns and two 6-inch guns. That armament will protect the Margarita Island side of the entrance, and it also controls the waters to the south. On the Toro Point side at Fort Sherman, we have eight mortars, two 14-inch guns, and two 6-inch guns. There are in addition two 6-inch guns provided at Manzaniilla Point, city of Colon. In my opinion, this armament is entirely adequate for the defense of the Atlantic side.

We have what we consider a wholly adequate mining defense for the approaches to each canal terminus. The waters on both sides lend themselves admirably to mine defense. There are no swift currents and the water is not excessively deep. The narrowness of the approaches and the absence of fog make range finding easy and accurate. We know exactly the line on which approach must be made.

The fortifications at both entrances were assigned names in advance of construction by the Secretary of War, Henry L. Stimson, in January, 1912. The forts and batteries comprising them on Toro Point were named Fort Sherman, in honor of General W. T. Sherman, U. S. A., who died February 14, 1891; those on Margarita Island, Fort Randolph, in honor of Major-

General Wallace F. Randolph, U. S. A., who died September 9, 1910; and those at Manzanilla Point, Colon, Fort De Lesseps, in honor of Count Ferdinand de Lesseps, who died December 7, 1894; those on the three islands in Panama Bay, Fort Grant, in honor of General U. S. Grant, U. S. A., who died July 23, 1885; and those at Balboa, Fort Amador, in honor of Doctor Manuel Amador Guerrero, first President of the Panama Republic, who died May 2, 1909. The batteries in the forts were named as follows:

FORT GRANT MILITARY RESERVATION

Battery Newton, in honor of Major-General John Newton, U. S. Vols. (Brigadier-General, Chief of Engineers, U. S. A.), who died May 1, 1895.

Battery Merritt, in honor of Major-General Wesley Merritt, U. S. A., who died December 3, 1910.

Battery Warren, in honor of Major-General Gouverneur K. Warren, U. S. Vols. (Lieutenant-Colonel, Corps of Engineers, U. S. A.), who died August 8, 1882.

Battery Buell, in honor of Major-General Don Carlos Buell, U. S. Vols. (Colonel, Assistant Adjutant-General, U. S. A.), who died November 19, 1898.

Battery Burnside, in honor of Major-General Ambrose E. Burnside, U. S. Vols. (First Lieutenant, Third U. S. Artillery), who died September 13, 1881.

Battery Parke, in honor of Major-General John G. Parke, U. S. Vols. (Colonel, Corps of Engineers, U. S. A.), who died December 16, 1900.

FORT AMADOR MILITARY RESERVATION

Battery Smith, in honor of Major-General Charles F. Smith, U. S. Vols. (Colonel, Third U. S. Infantry), who died April 25, 1862.

FORT SHERMAN MILITARY RESERVATION

Battery Howard, in honor of Major-General Oliver O. Howard, U. S. A., who died October 26, 1909.

Battery Stanley, in honor of Major-General David S. Stanley, U. S. Vols. (Brigadier-General, U. S. A.), who died March 13, 1902.

Battery Mower, in honor of Major-General Joseph A. Mower, U. S. Vols. (Colonel, Twenty-fifth Infantry), who died January 6, 1870.

Battery Kilpatrick, in honor of Major-General Judson Kilpatrick, U. S. Vols. (Captain, First Artillery), who died December 2, 1881.

FORT RANDOLPH MILITARY RESERVATION

Battery Tidball, in honor of Brigadier-General John C. Tidball, U. S. A., who died May 15, 1906.

Battery Webb, in honor of Brevet Major-General Alexander S. Webb, U. S. A. (Lieutenant-Colonel, Forty-fourth U. S. Infantry), who died February 12, 1911.

Battery Weed, in honor of Brigadier-General Stephen H. Weed, U. S. Vols. (Captain, Fifth U. S. Artillery), who was killed in action, July 2, 1863, at Gettysburg, Pa.

FORT DE LESSEPS MILITARY RESERVATION

Battery Morgan, in honor of Brigadier-General Charles H. Morgan, U. S. Vols. (Major, Fourth Artillery), who died December 20, 1875.

CHAPTER XII

THE CANAL ZONE A MILITARY RESERVATION

As an important factor in the plan of canal defence the entire Canal Zone, with the exception of about seven square miles, has been made a military reservation. The act passed by Congress* and approved by President Taft on August 24, 1912, "for the opening, maintenance, protection and operation of the Panama Canal, and the sanitation and government of the Canal Zone," authorized the President "to declare by Executive Order that all land and land under water within the limits of the Canal Zone is necessary for the construction, maintenance, operation, sanitation, or protection of the Panama Canal, and to extinguish, by agreement when advisable, all claims and titles of adverse claimants and occupants. Upon failure to secure by agreement title to any such parcel of land or land under water the adverse claim or occupancy shall be disposed of and title thereto secured in the United States and compensation therefor fixed and paid in the manner provided in the aforesaid treaty with the Republic of Panama, or such modification of such treaty as may hereafter be made."

Exercising the authority thus conferred, President Taft, on December 5, 1912, issued an executive order

*Appendix C.

in accordance with the terms of the act. In a subsequent order, issued on February 18, 1913, he exempted from the area defined in the preceding order the land known as the Sabanas, a tract comprising approximately seven square miles, lying between the city of Panama and the northeast boundary of the Canal Zone and bordering on the Pacific Ocean. It is a rolling country of fields and hills, and is occupied sparsely by the country residences of the more wealthy citizens of Panama city. Its fields, or sabanas, are used for grazing purposes mainly. Morgan and his piratical army marched over them when they advanced to the sacking of Old Panama in 1671, and on the northeastern portion of them the battle between his forces and those of the city was fought. It was not much of a battle, for the Panama army, which marched forth with much noise of drums and imposing display of banners, turned tail after the first clash of arms and fled in a panic back into the city, where they made a brief and futile resistance.

The Canal Zone, bought by the United States from the Republic of Panama for \$10,000,000, contains about 436 square miles. Of this area, at the time of the President's first order, the United States owned about 363 square miles, and 73 square miles were held in private ownership. The Zone begins at a point three marine miles from mean low-water mark in each ocean, and extends for five miles on each side of the centre line of the route of the canal. It includes the group of islands in the Bay of Panama named Perico, Naos Culebra, and Flamenco, and any lands and waters

outside of the prescribed limits which are necessary or convenient for canal purposes. About 95 square miles of the Canal Zone are beneath the waters of Gatun and Miraflores Lakes.

The cities of Panama and Colon are excluded from the Zone, but the United States has the right to enforce sanitary ordinances in those cities, and to maintain public order in them in case the Republic of Panama should not be able, in the judgment of the United States, to do so.

Under the treaty with Panama, the United States has the right to acquire by purchase or by the exercise of the right of eminent domain any lands, buildings, water rights, or other properties necessary and convenient for the construction, maintenance, operation, sanitation, and protection of the canal, and it can therefore at any time acquire the lands needed either within or without the Zone boundaries which are owned by private persons. The United States will also control the area to be covered by Gatun Lake, which extends beyond the lines of the Canal Zone.

The population of the Canal Zone in 1912, official census, was 62,810; of Panama City, 35,368; of Colon, 17,749.

Four joint commissions have been appointed for the purpose of adjudicating the prices that shall be paid to the owners of private lands needed for canal purposes. In accordance with the terms of the treaty with Panama, these commissions have been composed of four persons, two for each country, Panama and the United States; and, in case of disagreement, an umpire,

appointed jointly by the two governments, is provided whose decision shall be final.

The first commission, appointed in 1905, made awards aggregating \$55,607.07. The second, appointed in 1907, adjudicated the half-interest of the Pacific Mail Steamship Company in the islands of Culebra, Flamenco, Naos, and Perico, in Panama Bay, awarding the company \$20,000 for its improvements and \$20,000 for the land. The Panama Railroad Company held the other half-interest. This commission also assessed the damage done by a conflagration in the Malambo district of the city of Panama in 1906, which, it was claimed, was started by fumigation directed by the Isthmian Canal Commission. The commission did not fix the responsibility on the United States, and the matter is still pending; a bill providing for \$53,800 in payment for it has been introduced in several sessions of Congress, but has never been passed.

The third commission, appointed in 1908, agreed upon awards aggregating \$123,980, and its chairman, chosen as umpire in cases upon which the commission had failed to agree, made additional awards aggregating \$61,000.

The fourth commission, appointed by President Taft in January, 1913, was organized formally on the isthmus on March 6, 1913. It had before it a far greater task than had confronted any of its predecessors, for its prescribed duty was the "appraisement and settlement of damages to property in the Canal Zone" caused by making it a military reservation—that is, ridding it of all human habitation save that of the canal

civil and military forces. Previous commissions had been called upon to appraise and settle claims for particular tracts of land, but the duty of this body was to extinguish all claims for land or damages or improvements throughout the entire territory required for canal purposes. The various claims mounted into the thousands, and the hearing of them alone consumed many months. Before the commission began its work the entire area covered by the waters of Gatun Lake was cleared of human habitation below the eighty-seven-foot level. All buildings, commission and other, were removed. A large number of squatters were paid by the commission for their property, and many small claims were settled in that way through the legal counsel of the canal commission.

Decision to make the Canal Zone a military reservation was reached only after prolonged discussion in which considerable opposition was developed. It was thought at one time that the land in the Zone might be leased for agricultural purposes, and that many Americans in the employ of the canal commission who had become accustomed to life in the tropics might wish to remain and take up farming on the isthmus. Several ventures of this kind were made, but without success. All efforts to raise American vegetables on the isthmus have ended in failure. Only tropical products—bananas, mangoes, pineapples, papayas, and the like—can be grown to advantage, but for these there was very little suitable land remaining in the Zone after Gatun Lake was filled. In fact, virtually all the really productive land in the Zone was buried

under the lake, for it all lay in the valleys. It was made plain that very few, if any, Americans would become residents in the Zone if it were continued open to settlement, and no other nationality was wanted there, for settlements along the borders of the canal would be so many avenues of approach to it, and safety required that these should be under friendly control.

The area available for settlement was, at most, very small. No settlement of any kind could be allowed in the neighborhood of the earthworks about the locks or upon the lands over which an enemy would have to march to reach them. If settlement in the regions about Gatun Lake were permitted, roads would have to be kept open to them, a form of civil government, with schools, post-offices, and police protection, would have to be supplied, sanitation control and supervision exercised, and in case of settlements near canal works and structures fire protection would have to be given. All this would greatly increase the cost of governing the Zone, and the revenues would be inconsiderable.

With no settlements whatever along the borders of Gatun Lake, the dense jungle growth, unbroken by trails, will be the best possible protection, for it is virtually impassable for a hostile force. Fortifications at the entrances and about the locks are all that is necessary for canal protection, therefore, and with no one but Americans and their dependents in the Zone settlements the entrance of any persons with hostile intent will be instantly detected.

It has been asserted in many quarters that the locks might be destroyed by one or two men placing dyna-

mite or other high explosives in them. Colonel Goethals was asked for his views on this point at the hearing on fortification plans at Washington in January, 1913, and in his reply he said:

“In order to accomplish the destruction of the locks it would be necessary to place the charge very carefully in them. To do that would take time, and what would our men be doing in the meantime? One man could not carry a sufficient quantity to destroy the locks. You would have to locate the charge behind a gate and in a certain place behind the gate in order to disable the canal, and you must destroy the gates to destroy the canal. I cannot imagine what the people operating the canal and the men having charge of its defense would be doing in the meantime.” The same thing is true of dynamite dropped from a flying-machine. If it fell in the locks or on the lock walls, it could do no serious harm—it must get behind a lock gate to be effective for damage.

APPENDIXES

APPENDIX A

CANAL COMMISSIONS

FOR PRELIMINARY SURVEYS AND RECOMMENDATIONS

First Commission

Appointed by Proclamation by President Grant, March 13, 1872.

Brevet Major-General Andrew A. Humphreys, U. S. A.

*Professor Benjamin Pierce, of Massachusetts.

Captain Daniel Ammen, U. S. N.

Made final report, February, 1876, in favor of Nicaraguan route as possessing, both for the construction and maintenance of a canal, greater advantages and offering fewer difficulties, from engineering, commercial, and economical points of view, than any one of the other routes surveyed. Report sent to Congress in April, 1879, and printed.

Second Commission

DESIGNATED "NICARAGUAN CANAL COMMISSION"

Appointed by President McKinley, June 4, 1897.

Rear-Admiral John G. Walker, President.

Colonel Peter C. Hains, Corps of Engineers, U. S. A.

Lewis M. Haupt, C.E.

Made first report May 9, 1899.

Third Commission

DESIGNATED "ISTHMIAN CANAL COMMISSION"

Appointed by President McKinley on June 10, 1899.

Rear-Admiral John G. Walker, U. S. N., President.

Samuel Pasco.

* Resigned, December 1874; succeeded by Carlisle P. Patterson, Supt. U. S. Coast Survey.

George S. Morison, C.E.

Lieutenant-Colonel Oswald H. Ernst, Corps of Engineers,
U. S. A.

Lewis M. Haupt, C.E.

Alfred Noble, C.E.

Colonel Peter C. Hains, Corps of Engineers, U. S. A.

William H. Burr, C.E.

Professor Emory R. Johnson.

Lieutenant-Commander Sidney A. Staunton, U. S. N., Sec-
retary.

Reported on November 16, 1901, in favor of the Nicaraguan route; in a supplementary report on January 18, 1902, withdrew this finding and recommended the Panama route because the French Canal Company offered to sell its rights, privileges, etc., for \$40,000,000, having previously asked \$109,000,000.

FOR CANAL CONSTRUCTION

First Commission

Nominated by President Roosevelt, February 29, 1904.

Confirmed by the Senate, March 3, 1904.

John G. Walker, Rear-Admiral, U. S. N.

George W. Davis, Major-General (retired), U. S. A.

William Barclay Parsons, C.E., New York City.

William H. Burr, C.E., New York City.

Benj. M. Harrod, C.E., New Orleans, La.

Carl E. Grunsky, C.E., San Francisco, Cal.

Frank J. Hecker, Detroit, Mich.

Salary, \$12,000 each.

On June 6, 1904, Dominick I. Murphy was elected secretary of the commission, holding the position till May 31, 1905, when he resigned.

Second Commission

Nominated by President Roosevelt, March 4, 1905.

Theodore P. Shonts, Chairman; salary, \$30,000.

Charles E. Magoon, Member and Governor of the Canal Zone; salary, \$10,000.

John F. Wallace, Member and Chief Engineer; salary, \$25,000.

Rear-Admiral Mordecai T. Endicott, U. S. N.; salary, \$7,500.

Brigadier-General Peter C. Hains, U. S. A. (retired); salary, \$7,500.

Colonel Oswald H. Ernst, Corps of Engineers, U. S. A.; salary, \$7,500.

Benj. M. Harrod, C.E., salary, \$7,500.

Nominated after adjournment of Congress and never confirmed in its original form. All nominations save that of Wallace, who resigned on June 28, 1905, and Ernst, who was transferred in 1906 to the Mississippi River Commission, were confirmed March, 1907.

On September 7, 1905, Joseph Bucklin Bishop was elected secretary of the commission.

Third Commission

Nominated by President Roosevelt, March, 1907.

Confirmed by the Senate, March, 1907.

Lieutenant-Colonel George W. Goethals, U. S. A., Chairman and Chief Engineer; salary, \$15,000.

Major D. D. Gaillard, U. S. A.

Major William L. Sibert, U. S. A.

Civil Engineer H. H. Rousseau, U. S. N. } salary \$14,000.

Colonel W. C. Gorgas, U. S. A. }

*J. C. S. Blackburn.

†Jackson Smith.

Joseph Bucklin Bishop, Secretary

* Succeeded by Maurice H. Thatcher, April 10, 1910, who was succeeded by Richard L. Metcalfe on August 8, 1913.

† Succeeded by Lieutenant-Colonel H. F. Hodges, Engineering Corps, U. S. A., July 16, 1908.

APPENDIX B

CANAL APPROPRIATIONS AND EXPENDITURES

APPROPRIATIONS

Payment to the new Panama Canal company..	\$40,000,000.00
Payment to Republic of Panama.....	10,000,000.00
Appropriation, June 28, 1902.....	10,000,000.00
Appropriation, December 21, 1905.....	11,000,000.00
Deficiency, February 27, 1906.....	5,990,786.00
Appropriation, June 30, 1906.....	25,456,415.08
Appropriation, March 4, 1907.....	27,161,367.50
Deficiency, February 15, 1908.....	12,178,900.00
Appropriation, May 27, 1908.....	29,187,000.00
Deficiency, March 4, 1909.....	5,458,000.00
Appropriation, March 4, 1909.....	33,638,000.00
Deficiency, February 25, 1910.....	76,000.00
Appropriation, June 25, 1910.....	37,855,000.00
Appropriation, March 4, 1911.....	45,560,000.00
Appropriation, August 24, 1912.....	28,980,000.00
Appropriation, June 23, 1913.....	16,265,393.00
Private Acts and Court Judgments.....	21,608.01
Total.....	<u>\$338,828,469.59</u>
Appropriations for fortifications, March 4, 1911..	3,000,000.00
Appropriation for fortifications, August 24, 1912.	2,806,950.00
Appropriation for fortifications, June 23, 1913..	4,870,000.00

CLASSIFIED EXPENDITURES TO MARCH 1, 1913

Department of Construction and Engineering..	\$171,790,041.08
Department of Construction and Engineering Plant.....	2,396,127.35

Department of Sanitation.....	\$15,796,420.16
Department of Civil Administration.....	6,197,073.40
Department of Law.....	37,360.43
Panama Railroad, second main track.....	1,123,477.93
Panama Railroad, relocated line.....	8,984,922.18
Purchase and repair of steamers.....	2,680,112.01
Zone water-works and sewers.....	5,289,485.06
Zone roadways.....	1,599,153.86
Loans to Panama Railroad Company.....	3,247,332.11
Construction and repair of buildings.....	10,245,919.64
Purchase from new Panama Canal company...	40,000,000.00
Payment to Republic of Panama.....	10,000,000.00
Miscellaneous.....	4,185,412.41
Total.....	<u>\$283,572,837.62</u>

Expenditures for fortifications to March 1, 1913.. 2,537,752.38

The balances carried in expenditure accounts, which are included in the last item above, for water-works, sewers, and pavements in the cities of Panama and Colon amounted altogether to \$2,405,727.91. The unexpended balance in the appropriation for sanitation in the cities of Panama and Colon, available for expenditures on water-works, sewers, and pavements, was \$77,131.29, including transfer of appropriations for quarter ended December 31, 1912.

APPENDIX C*

AN ACT

TO PROVIDE FOR THE OPENING, MAINTENANCE, PROTECTION,
AND OPERATION OF THE PANAMA CANAL, AND THE SANITA-
TION AND GOVERNMENT OF THE CANAL ZONE.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the zone of land and land under water of the width of ten miles extending to the distance of five miles on each side of the center line of the route of the canal now being constructed thereon, which zone begins in the Caribbean Sea three marine miles from mean low-water mark and extends to and across the Isthmus of Panama into the Pacific Ocean to the distance of three marine miles from mean low-water mark, excluding therefrom the cities of Panama and Colon and their adjacent harbors located within said zone, as excepted in the treaty with the Republic of Panama dated November eighteenth, nineteen hundred and three, but including all islands within said described zone, and in addition thereto the group of islands in the Bay of Panama named Perico, Naos, Culebra, and Flamenco, and any lands and waters outside of said limits above described which are necessary or convenient or from time to time may become necessary or convenient for the construction, maintenance, operation, sanitation, or protection of the said canal or of any auxiliary canals, lakes, or other works necessary or convenient for the construction, maintenance, operation, sanitation, or protection of said canal, the use, occupancy, or control whereof were granted to

* [Public—No. 337.] [H. R. 21969.]

the United States by the treaty between the United States and the Republic of Panama, the ratifications of which were exchanged on the twenty-sixth day of February, nineteen hundred and four, shall be known and designated as the Canal Zone, and the canal now being constructed thereon shall hereafter be known and designated as the Panama Canal. The President is authorized, by treaty with the Republic of Panama, to acquire any additional land or land under water not already granted, or which was excepted from the grant, that he may deem necessary for the operation, maintenance, sanitation, or protection of the Panama Canal, and to exchange any land or land under water not deemed necessary for such purposes for other land or land under water which may be deemed necessary for such purposes, which additional land or land under water so acquired shall become part of the Canal Zone.

SEC. 2. That all laws, orders, regulations, and ordinances adopted and promulgated in the Canal Zone by order of the President for the government and sanitation of the Canal Zone and the construction of the Panama Canal are hereby ratified and confirmed as valid and binding until Congress shall otherwise provide. The existing courts established in the Canal Zone by Executive order are recognized and confirmed to continue in operation until the courts provided for in this Act shall be established.

SEC. 3. That the President is authorized to declare by Executive order that all land and land under water within the limits of the Canal Zone is necessary for the construction, maintenance, operation, sanitation, or protection of the Panama Canal, and to extinguish, by agreement when advisable, all claims and titles of adverse claimants and occupants. Upon failure to secure by agreement title to any such parcel of land or land under water the adverse claim or occupancy shall be disposed of and title thereto secured in the United States and compensation therefor fixed and paid in the manner provided in the aforesaid treaty with the Republic of Panama, or such modification of such treaty as may hereafter be made.

SEC. 4. That when in the judgment of the President the construction of the Panama Canal shall be sufficiently advanced toward completion to render the further services of the Isthmian Canal Commission unnecessary the President is authorized by Executive order to discontinue the Isthmian Canal Commission, which, together with the present organization, shall then cease to exist; and the President is authorized thereafter to complete, govern, and operate the Panama Canal and govern the Canal Zone, or cause them to be completed, governed, and operated, through a governor of the Panama Canal and such other persons as he may deem competent to discharge the various duties connected with the completion, care, maintenance, sanitation, operation, government, and protection of the canal and Canal Zone. If any of the persons appointed or employed as aforesaid shall be persons in the military or naval service of the United States, the amount of the official salary paid to any such person shall be deducted from the amount of salary or compensation provided by or which shall be fixed under the terms of this Act. The governor of the Panama Canal shall be appointed by the President, by and with the advice and consent of the Senate, commissioned for a term of four years, and until his successor shall be appointed and qualified. He shall receive a salary of ten thousand dollars a year. All other persons necessary for the completion, care, management, maintenance, sanitation, government, operation, and protection of the Panama Canal and Canal Zone shall be appointed by the President, or by his authority, removable at his pleasure, and the compensation of such persons shall be fixed by the President, or by his authority, until such time as Congress may by law regulate the same, but salaries or compensation fixed hereunder by the President shall in no instance exceed by more than twenty-five per centum the salary or compensation paid for the same or similar services to persons employed by the Government in continental United States. That upon the completion of the Panama Canal the President shall cause the same to be officially and formally opened for use and operation.

Before the completion of the canal, the Commission of Arts may make report to the President of their recommendation regarding the artistic character of the structures of the canal, such report to be transmitted to Congress.

SEC. 5. That the President is hereby authorized to prescribe and from time to time change the tolls that shall be levied by the Government of the United States for the use of the Panama Canal: *Provided*, That no tolls, when prescribed as above, shall be changed, unless six months' notice thereof shall have been given by the President by proclamation. No tolls shall be levied upon vessels engaged in the coastwise trade of the United States. That section forty-one hundred and thirty-two of the Revised Statutes is hereby amended to read as follows:

"SEC. 4132. Vessels built within the United States and belonging wholly to citizens thereof; and vessels which may be captured in war by citizens of the United States and lawfully condemned as prize, or which may be adjudged to be forfeited for a breach of the laws of the United States; and seagoing vessels, whether steam or sail, which have been certified by the Steamboat-Inspection Service as safe to carry dry and perishable cargo, not more than five years old at the time they apply for registry, wherever built, which are to engage only in trade with foreign countries or with the Philippine Islands and the islands of Guam and Tutuila, being wholly owned by citizens of the United States or corporations organized and chartered under the laws of the United States or of any State thereof, the president and managing directors of which shall be citizens of the United States or corporations organized and chartered under the laws of the United States or of any State thereof, the president and managing directors of which shall be citizens of the United States, and no others, may be registered as directed in this title. Foreign-built vessels registered pursuant to this Act shall not engage in the coastwise trade: *Provided*, That a foreign-built yacht, pleasure boat, or vessel not used or intended to be used for trade admitted to American registry pursuant to this section shall not be exempt from the collection of ad va-

lorem duty provided in section thirty-seven of the Act approved August fifth, nineteen hundred and nine, entitled 'An Act to provide revenue, equalize duties, and encourage the industries of the United States, and for other purposes.' That all materials of foreign production which may be necessary for the construction or repair of vessels built in the United States and all such materials necessary for the building or repair of their machinery and all articles necessary for their outfit and equipment may be imported into the United States free of duty under such regulations as the Secretary of the Treasury may prescribe: *Provided further*, That such vessels so admitted under the provisions of this section may contract with the Postmaster General under the Act of March third, eighteen hundred and ninety-one, entitled 'An Act to provide for ocean mail service between the United States and foreign ports, and to promote commerce,' so long as such vessels shall in all respects comply with the provisions and requirements of said Act."

Tolls may be based upon gross or net registered tonnage, displacement tonnage, or otherwise, and may be based on one form of tonnage for warships and another for ships of commerce. The rate of tolls may be lower upon vessels in ballast than upon vessels carrying passengers or cargo. When based upon net registered tonnage for ships of commerce the tolls shall not exceed one dollar and twenty-five cents per net registered ton, nor be less, other than for vessels of the United States and its citizens, than the estimated proportionate cost of the actual maintenance and operation of the canal, subject, however, to the provisions of article nineteen of the convention between the United States and the Republic of Panama, entered into November eighteenth, nineteen hundred and three. If the tolls shall not be based upon net registered tonnage, they shall not exceed the equivalent of one dollar and twenty-five cents per net registered ton as nearly as the same may be determined, nor be less than the equivalent of seventy-five cents per net registered ton. The toll for each passenger shall not be more than one dollar and fifty cents. The President is au-

thorized to make and from time to time amend regulations governing the operation of the Panama Canal, and the passage and control of vessels through the same or any part thereof, including the locks and approaches thereto, and all rules and regulations affecting pilots and pilotage in the canal or the approaches thereto through the adjacent waters.

Such regulations shall provide for prompt adjustment by agreement and immediate payment of claims for damages which may arise from injury to vessels, cargo, or passengers from the passing of vessels through the locks under the control of those operating them under such rules and regulations. In case of disagreement suit may be brought in the district court of the Canal Zone against the governor of the Panama Canal. The hearing and disposition of such cases shall be expedited and the judgment shall be immediately paid out of any moneys appropriated or allotted for canal operation.

The President shall provide a method for the determination and adjustment of all claims arising out of personal injuries to employes thereafter occurring while directly engaged in actual work in connection with the construction, maintenance, operation, or sanitation of the canal or of the Panama Railroad, or of any auxiliary canals, locks, or other works necessary and convenient for the construction, maintenance, operation, or sanitation of the canal, whether such injuries result in death or not, and prescribe a schedule of compensation therefor, and may revise and modify such method and schedule at any time; and such claims, to the extent they shall be allowed on such adjustment, if allowed at all, shall be paid out of the moneys hereafter appropriated for that purpose or out of the funds of the Panama Railroad Company, if said company was responsible for said injury, as the case may require. And after such method and schedule shall be provided by the President, the provisions of the Act entitled "An Act granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment," approved May thirtieth, nineteen hundred and eight, and of the Act en-

titled "An Act relating to injured employees on the Isthmian Canal," approved February twenty-fourth, nineteen hundred and nine, shall not apply to personal injuries thereafter received and claims for which are subject to determination and adjustment as provided in this section.

SEC. 6. That the President is authorized to cause to be erected, maintained, and operated, subject to the International Convention and the Act of Congress to regulate radio-communication, at suitable places along the Panama Canal and the coast adjacent to its two terminals, in connection with the operation of said canal, such wireless telegraphic installations as he may deem necessary for the operation, maintenance, sanitation, and protection of said canal, and for other purposes. If it is found necessary to locate such installations upon territory of the Republic of Panama, the President is authorized to make such agreement with said Government as may be necessary, and also to provide for the acceptance and transmission, by said system, of all private and commercial messages, and those of the Government of Panama, on such terms and for such tolls as the President may prescribe: *Provided*, That the messages of the Government of the United States and the departments thereof, and the management of the Panama Canal, shall always be given precedence over all other messages. The President is also authorized, in his discretion, to enter into such operating agreements or leases with any private wireless company or companies as may best insure freedom from interference with the wireless telegraphic installations established by the United States. The President is also authorized to establish, maintain, and operate, through the Panama Railroad Company or otherwise, dry docks, repair shops, yards, docks, wharves, warehouses, storehouses, and other necessary facilities and appurtenances for the purpose of providing coal and other materials, labor, repairs, and supplies for vessels of the Government of the United States and, incidentally, for supplying such at reasonable prices to passing vessels, in accordance with appropriations hereby authorized to be made from time to time by

Congress as a part of the maintenance and operation of the said canal. Moneys received from the conduct of said business may be expended and reinvested for such purposes without being covered into the Treasury of the United States; and such moneys are hereby appropriated for such purposes, but all deposits of such funds shall be subject to the provisions of existing law relating to the deposit of other public funds of the United States, and any net profits accruing from such business shall annually be covered into the Treasury of the United States. Monthly reports of such receipts and expenditures shall be made to the President by the persons in charge, and annual reports shall be made to the Congress.

SEC. 7. That the governor of the Panama Canal shall, in connection with the operation of such canal, have official control and jurisdiction over the Canal Zone and shall perform all duties in connection with the civil government of the Canal Zone, which is to be held, treated, and governed as an adjunct of such Panama Canal. Unless in this Act otherwise provided all existing laws of the Canal Zone referring to the civil governor or the civil administration of the Canal Zone shall be applicable to the governor of the Panama Canal, who shall perform all such executive and administrative duties required by existing law. The President is authorized to determine or cause to be determined what towns shall exist in the Canal Zone and subdivide and from time to time resubdivide said Canal Zone into subdivisions, to be designated by name or number, so that there shall be situated one town in each subdivision, and the boundaries of each subdivision shall be clearly defined. In each town there shall be a magistrate's court with exclusive original jurisdiction coextensive with the subdivision in which it is situated of all civil cases in which the principal sum claimed does not exceed three hundred dollars, and all criminal cases wherein the punishment that may be imposed shall not exceed a fine of one hundred dollars, or imprisonment not exceeding thirty days, or both, and all violations of police regulations and ordinances and all actions involving possession or title to personal property

or the forcible entry and detainer of real estate. Such magistrates shall also hold preliminary investigations in charges of felony and offenses under section ten of this Act, and commit or bail in bailable cases to the district court. A sufficient number of magistrates and constables, who must be citizens of the United States, to conduct the business of such courts, shall be appointed by the governor of the Panama Canal for terms of four years and until their successors are appointed and qualified, and the compensation of such persons shall be fixed by the President, or by his authority, until such time as Congress may by law regulate the same. The rules governing said courts and prescribing the duties of said magistrates and constables, oaths and bonds, the times and places of holding such courts, the disposition of fines, costs, forfeitures, enforcements of judgments, providing for appeals therefrom to the district court, and the disposition, treatment, and pardon of convicts shall be established by order of the President. The governor of the Panama Canal shall appoint all notaries public, prescribe their powers and duties, their official seal, and the fees to be charged and collected by them.

SEC. 8. That there shall be in the Canal Zone one district court with two divisions, one including Balboa and the other including Cristobal; and one district judge of the said district, who shall hold his court in both divisions at such time as he may designate by order, at least once a month in each division. The rules of practice in such district court shall be prescribed or amended by order of the President. The said district court shall have original jurisdiction of all felony cases, of offenses arising under section ten of this Act, all causes in equity; admiralty and all cases at law involving principal sums exceeding three hundred dollars and all appeals from judgments rendered in magistrates' courts. The jurisdiction in admiralty herein conferred upon the district judge and the district court shall be the same that is exercised by the United States district judges and the United States district courts, and the procedure and practice shall also be the same. The district court or the

judge thereof shall also have jurisdiction of all other matters and proceedings not herein provided for which are now within the jurisdiction of the Supreme Court of the Canal Zone, of the Circuit Court of the Canal Zone, the District Court of the Canal Zone, or the judges thereof. Said judge shall provide for the selection, summoning, serving, and compensation of jurors from among the citizens of the United States, to be subject to jury duty in either division of such district, and a jury shall be had in any criminal case or civil case at law originating in said court on the demand of either party. There shall be a district attorney and a marshal for said district. It shall be the duty of the district attorney to conduct all business, civil and criminal, for the Government, and to advise the governor of the Panama Canal on all legal questions touching the operation of the canal and the administration of civil affairs. It shall be the duty of the marshal to execute all process of the court, preserve order therein, and do all things incident to the office of marshal. The district judge, the district attorney, and the marshal shall be appointed by the President, by and with the advice and consent of the Senate, for terms of four years each, and until their successors are appointed and qualified, and during their terms of office shall reside within the Canal Zone, and shall hold no other office nor serve on any official board or commission nor receive any emoluments except their salaries. The district judge shall receive the same salary paid the district judges of the United States, and shall appoint the clerk of said court, and may appoint one assistant when necessary, who shall receive salaries to be fixed by the President. The district judge shall be entitled to six weeks' leave of absence each year with pay. During his absence or during any period of disability or disqualification from sickness or otherwise to discharge his duties the same shall be temporarily performed by any circuit or district judge of the United States who may be designated by the President, and who, during such service, shall receive the additional mileage and per diem allowed by law to district judges of the United States when holding court away from their homes.

The district attorney and the marshal shall be paid each a salary of five thousand dollars per annum.

SEC. 9. That the records of the existing courts and all causes, proceedings, and criminal prosecutions pending therein as shown by the dockets thereof, except as herein otherwise provided, shall immediately upon the organization of the courts created by this Act be transferred to such new courts having jurisdiction of like cases, be entered upon the dockets thereof, and proceed as if they had originally been brought therein, whereupon all the existing courts, except the Supreme Court of the Canal Zone, shall cease to exist. The President may continue the Supreme Court of the Canal Zone and retain the judges thereof in office for such time as to him may seem necessary to determine finally any causes and proceedings which may be pending therein. All laws of the Canal Zone imposing duties upon the clerks or ministerial officers of existing courts shall apply and impose such duties upon the clerks and ministerial officers of the new courts created by this Act having jurisdiction of like cases, matters, and duties.

All existing laws in the Canal Zone governing practice and procedure in existing courts shall be applicable and adapted to the practice and procedure in the new courts.

The Circuit Court of Appeals of the Fifth Circuit of the United States shall have jurisdiction to review, revise, modify, reverse, or affirm the final judgments and decrees of the District Court of the Canal Zone and to render such judgments as in the opinion of the said appellate court should have been rendered by the trial court in all actions and proceedings in which the Constitution, or any statute, treaty, title, right, or privilege of the United States, is involved and a right thereunder denied, and in cases in which the value in controversy exceeds one thousand dollars, to be ascertained by the oath of either party, or by other competent evidence, and also in criminal causes wherein the offense charged is punishable as a felony. And such appellate jurisdiction, subject to the right of review by or appeal to the Supreme Court of the United States as in other

cases authorized by law, may be exercised by said circuit court of appeals in the same manner, under the same regulations, and by the same procedure as nearly as practicable as is done in reviewing the final judgments and decrees of the district courts of the United States.

SEC. 10. That after the Panama Canal shall have been completed and opened for operation the governor of the Panama Canal shall have the right to make such rules and regulations, subject to the approval of the President, touching the right of any person to remain upon or pass over any part of the Canal Zone as may be necessary. Any person violating any of such rules or regulations shall be guilty of a misdemeanor, and on conviction in the District Court of the Canal Zone shall be punished by a fine not exceeding five hundred dollars or by imprisonment not exceeding a year, or both, in the discretion of the court. It shall be unlawful for any person, by any means or in any way, to injure or obstruct, or attempt to injure or obstruct, any part of the Panama Canal or the locks thereof or the approaches thereto. Any person violating this provision shall be guilty of a felony, and on conviction in the District Court of the Canal Zone shall be punished by a fine not exceeding ten thousand dollars or by imprisonment not exceeding twenty years, or both, in the discretion of the court. If the act shall cause the death of any person within a year and a day thereafter, the person so convicted shall be guilty of murder and shall be punished accordingly.

SEC. 11. That section five of the Act to regulate commerce, approved February fourth, eighteen hundred and eighty-seven, as heretofore amended, is hereby amended by adding thereto a new paragraph at the end thereof, as follows:

“From and after the first day of July, nineteen hundred and fourteen, it shall be unlawful for any railroad company or other common carrier subject to the Act to regulate commerce to own, lease, operate, control, or have any interest whatsoever (by stock ownership or otherwise, either directly, indirectly, through any holding company, or by stockholders or directors in com-

mon, or in any other manner) in any common carrier by water operated through the Panama Canal or elsewhere with which said railroad or other carrier aforesaid does or may compete for traffic or any vessel carrying freight or passengers upon said water route or elsewhere with which said railroad or other carrier aforesaid does or may compete for traffic; and in case of the violation of this provision each day in which such violation continues shall be deemed a separate offense."

Jurisdiction is hereby conferred on the Interstate Commerce Commission to determine questions of fact as to the competition or possibility of competition, after full hearing, on the application of any railroad company or other carrier. Such application may be filed for the purpose of determining whether any existing service is in violation of this section and pray for an order permitting the continuance of any vessel or vessels already in operation, or for the purpose of asking an order to install new service not in conflict with the provisions of this paragraph. The commission may on its own motion or the application of any shipper institute proceedings to inquire into the operation of any vessel in use by any railroad or other carrier which has not applied to the commission and had the question of competition or the possibility of competition determined as herein provided. In all such cases the order of said commission shall be final.

If the Interstate Commerce Commission shall be of the opinion that any such existing specified service by water other than through the Panama Canal is being operated in the interest of the public and is of advantage to the convenience and commerce of the people, and that such extension will neither exclude, prevent, nor reduce competition on the route by water under consideration, the Interstate Commerce Commission may, by order, extend the time during which such service by water may continue to be operated beyond July first, nineteen hundred and fourteen. In every case of such extension the rates, schedules, and practices of such water carrier shall be filed with the Interstate Commerce Commission and shall be subject to the

act to regulate commerce and all amendments thereto in the same manner and to the same extent as is the railroad or other common carrier controlling such water carrier or interested in any manner in its operation: *Provided*, Any application for extension under the terms of this provision filed with the Interstate Commerce Commission prior to July first, nineteen hundred and fourteen, but for any reason not heard and disposed of before said date, may be considered and granted thereafter.

No vessel permitted to engage in the coastwise or foreign trade of the United States shall be permitted to enter or pass through said canal if such ship is owned, chartered, operated, or controlled by any person or company which is doing business in violation of the provisions of the Act of Congress approved July second, eighteen hundred and ninety, entitled "An Act to protect trade and commerce against unlawful restraints and monopolies," or the provisions of sections seventy-three to seventy-seven, both inclusive, of an Act approved August twenty-seventh, eighteen hundred and ninety-four, entitled "An Act to reduce taxation, to provide revenue for the Government, and for other purposes," or the provisions of any other Act of Congress amending or supplementing the said Act of July second, eighteen hundred and ninety, commonly known as the Sherman Antitrust Act, and amendments thereto, or said sections of the Act of August twenty-seventh, eighteen hundred and ninety-four. The question of fact may be determined by the judgment of any court of the United States of competent jurisdiction in any cause pending before it to which the owners or operators of such ship are parties. Suit may be brought by any shipper or by the Attorney General of the United States.

That section six of said Act to regulate commerce, as heretofore amended, is hereby amended by adding a new paragraph at the end thereof, as follows:

"When property may be or is transported from point to point in the United States by rail and water through the Panama Canal or otherwise, the transportation being by a common

carrier or carriers, and not entirely within the limits of a single State, the Interstate Commerce Commission shall have jurisdiction of such transportation and of the carriers, both by rail and by water, which may or do engage in the same, in the following particulars, in addition to the jurisdiction given by the Act to regulate commerce, as amended June eighteenth, nineteen hundred and ten:

“(a) To establish physical connection between the lines of the rail carrier and the dock of the water carrier by directing the rail carrier to make suitable connection between its line and a track or tracks which have been constructed from the dock to the limits of its right of way, or by directing either or both the rail and water carrier, individually or in connection with one another, to construct and connect with the lines of the rail carrier a spur track or tracks to the dock. This provision shall only apply where such connection is reasonably practicable, can be made with safety to the public, and where the amount of business to be handled is sufficient to justify the outlay.

“The commission shall have full authority to determine the terms and conditions upon which these connecting tracks, when constructed, shall be operated, and it may, either in the construction or the operation of such tracks, determine what sum shall be paid to or by either carrier. The provisions of this paragraph shall extend to cases where the dock is owned by other parties than the carrier involved.

“(b) To establish through routes and maximum joint rates between and over such rail and water lines, and to determine all the terms and conditions under which such lines shall be operated in the handling of the traffic embraced.

“(c) To establish maximum proportional rates by rail to and from the ports to which the traffic is brought, or from which it is taken by the water carrier, and to determine to what traffic and in connection with what vessels and upon what terms and conditions such rates shall apply. By proportional rates are meant those which differ from the corresponding local rates to and from the port and which apply only to traffic which has

been brought to the port or is carried from the port by a common carrier by water.

“(d) If any rail carrier subject to the Act to regulate commerce enters into arrangements with any water carrier operating from a port in the United States to a foreign country, through the Panama Canal or otherwise, for the handling of through business between interior points of the United States and such foreign country, the Interstate Commerce Commission may require such railway to enter into similar arrangements with any or all other lines of steamships operating from said port to the same foreign country.”

The orders of the Interstate Commerce Commission relating to this section shall only be made upon formal complaint or in proceedings instituted by the commission of its own motion and after full hearing. The orders provided for in the two amendments to the Act to regulate commerce enacted in this section shall be served in the same manner and enforced by the same penalties and proceedings as are the orders of the commission made under the provisions of section fifteen of the Act to regulate commerce, as amended June eighteenth, nineteen hundred and ten, and they may be conditioned for the payment of any sum or the giving of security for the payment of any sum or the discharge of any obligation which may be required by the terms of said order.

SEC. 12. That all laws and treaties relating to the extradition of persons accused of crime in force in the United States, to the extent that they may not be in conflict with or superseded by any special treaty entered into between the United States and the Republic of Panama with respect to the Canal Zone, and all laws relating to the rendition of fugitives from justice as between the several States and Territories of the United States, shall extend to and be considered in force in the Canal Zone, and for such purposes and such purposes only the Canal Zone shall be considered and treated as an organized Territory of the United States.

SEC. 13. That in time of war in which the United States shall

be engaged, or when, in the opinion of the President, war is imminent, such officer of the Army as the President may designate shall, upon the order of the President, assume and have exclusive authority and jurisdiction over the operation of the Panama Canal and all of its adjuncts, appendants, and appurtenances, including the entire control and government of the Canal Zone, and during a continuance of such condition the governor of the Panama Canal shall, in all respects and particulars as to the operation of such Panama Canal, and all duties, matters, and transactions affecting the Canal Zone, be subject to the order and direction of such officer of the Army.

SEC. 14. That this Act shall be known as, and referred to as, the Panama Canal Act, and the right to alter, amend, or repeal any or all of its provisions or to extend, modify, or annul any rule or regulation made under its authority is expressly reserved.

Approved, August 24, 1912.

APPENDIX D

EQUIPMENT AT PERIOD OF GREATEST ACTIVITY

CANAL SERVICE

Steam shovels:

105-ton, 5-cubic-yard dippers.....	15	
95-ton, 4- and 5-cubic-yard dippers.....	30	
70-ton, 2½- and 3-cubic-yard dippers.....	33	
66-ton, 2½-cubic-yard dippers.....	10	
45-ton, 1¾-cubic-yard dippers.....	11	
26-ton.....	1	
Trenching shovel, ¾-cubic-yard dipper.....	1	
Total.....		101

Locomotives:

American—

106 tons.....	100	
105 tons.....	41	
117 tons.....	20	
Total.....		161

French.....	104	
Narrow gauge, American, 16 tons.....	33	
Electric.....	9	
Total.....		307

Drills:

Mechanical churn, or well.....	196	
Tripod.....	357	
Total.....		553

Cars:

Flat, used with unloading plows.....	1,760
Steel dumps, large.....	596
Steel dumps, small.....	1,207
Ballast dumps.....	24
Steel flats.....	487
Narrow gauge.....	209
Motor.....	6
Pay Car.....	1
Pay Certificate.....	1
Automatic, electric.....	45
Decauville.....	224
Special, shops.....	12
Total.....	4,572

Spreaders.....	26
Trackshifters.....	9
Unloaders.....	30
Pile-drivers.....	14

Dredges:

French ladder.....	7
Dipper.....	3
Pipe-line.....	7
Sea-going suction.....	2
Clam shell.....	1

Total..... 20

Cranes.....	47
Rock-breaker.....	1
Tugs.....	11
Towboat.....	1
House-boats.....	3
Clapets.....	12
Pile-driver, floating.....	3
Crane-boat.....	1

APPENDIX D

449

Barges, lighters and scows.....	72
Launches.....	29
Drill-boats.....	2
Floating derricks.....	2

PANAMA RAILROAD

Locomotives:	
Road (12 oil-burners).....	36
Switch.....	26
Total.....	62

Cars:	
Coaches.....	57
Freight.....	1,434
Total.....	1,491

Cranes:	
Locomotive.....	2
Wrecking.....	2
Total.....	4

Pile-drivers:	
Track.....	1
Floating.....	1
Total.....	2

Tugboat.....	1
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Lighters:	
Coal, all steel.....	5
Cargo, steel and iron.....	8
Total.....	13

Motor-boats.....	2
Steam ditcher.....	1

APPENDIX E

DISTANCES IN NAUTICAL MILES

SAVED FROM NEW YORK VIA THE PANAMA CANAL ON TRADE ROUTES

San Francisco:		Honolulu:	
Magellan.....	13,135	Magellan.....	13,312
Panama.....	5,262	Panama.....	6,700
Saved.....	7,873	Saved.....	6,612
Guayaquil:		Manila:	
Magellan.....	10,215	Suez.....	11,589
Panama.....	2,810	* Panama.....	11,548
Saved.....	7,405	Saved.....	41
Callao:		Yokohama:	
Magellan.....	9,613	Suez.....	13,079
Panama.....	3,363	* Panama.....	9,798
Saved.....	6,250	Saved.....	3,281
Iquique:		Hongkong:	
Magellan.....	9,143	Suez.....	11,628
Panama.....	4,004	* Panama.....	11,383
Saved.....	5,139	Saved.....	245
Valparaiso:		Melbourne:	
Magellan.....	8,380	Magellan.....	12,852
Panama.....	4,633	Panama.....	10,030
Saved.....	3,747	Saved.....	2,822

* Via San Francisco and the Great Circle.

INDEX

INDEX

- ABBOT, Henry L., 165, 166.
 Acla, 9.
 Adams, Charles Francis, 288.
 Adams, John Quincy, 36.
 Agramonte, Dr. Aristides, 225.
 Allen, Henry A., 208 n.
 Amador, Fort, 413.
 Amador, Mrs., 170.
 Amador, President. (See *Amador Guerrero*.)
 Amador Guerrero, Dr. Manuel, 23, 139, 170, 413.
 Amaya, General, 127, 128, 132.
 Ammen, Captain Daniel, 56, 425.
 Ancon, 151, 153, 328.
 Ancon Hill, 23, 79, 95, 363, 391, 393.
 Ancon Hospital, 79, 89, 97.
 Andagoya, Pascual, 29.
 Anderson, Mr., 36.
 Appleton, Nathan, 70, 82.
 Arosema, Pablo, 139.
 Aspinwall (Colon), city of, 47, 80, 81.
 Aspinwall, W. H., 45.
Atlanta, U. S. Ship, 126, 132.
 Atrato River, 55.
 Avila, Pedro Arias de (Pedrarias), 7, 8, 9, 13, 15, 16.

 BALBOA, Vasco Nuñez de, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 28.
 Balboa, town of, 95, 328, 363, 384, 392, 396, 398, 399, 402, 406, 438.
 Balboa Dump, 393.
 Balboa Hill, 7.
 Baldwin, James L., 47, 48.
 Bas Obispo, 79, 203, 353.
 Bastianelli, Dr. G., 232.
 Bernhardt, Sarah, 79 n.
 Bertrans, Marcel, 185.
 Biddle, Charles, 33.
 Bied, W. G., 339.
 Bigelow, John, 82.
 Bignami, Dr. A., 232.
 Bionne, Henry, 93, 94.
 Bishop, Joseph Bucklin, 427.
 Bixby, General, 408.
 Blackburn, Senator J. C. S., 177, 427.
 Blaine, James G., 40.
 Blanchet, 94.
 Blasert, 94.
 Bohio, 203, 204, 324, 325.
 Bolich, D. W., 191, 192.
Boston, U. S. Ship, 126, 133.
 Boswell, Helen Varick, 278.
 Boyer, Léon, 95, 99.
 Brenner, Victor D., 172.
 Brooke, Lieutenant Mark, 146.
 Bryce, James, 205.
 Budd, Ralph, 323.
 Buell, General Don Carlos, 413.
 Bunau-Varilla, Philippe, 95, 137.
 Burnside, General Ambrose E., 413.
 Burr, Colonel Edward, 408.
 Burr, William H., 165, 166, 186, 426.

 CALEDONIA BAY, 10.
 California, 44.
 Callao, 450.
 Canal Zone, 138-139, 145-146, 147-148, 149-154, 160-163, 238 ff., 250 ff., 259 ff., 415-421, 430-446.
 Caribbean Sea, 430.

- Carpenter, Admiral, 82.
 Carroll, Dr. James, 225, 226, 227, 228, 230, 231, 245, 246, 247.
 Cartagena, Colombia, 23 n.
Cartagena, Colombian gunboat, 127, 130.
 Carter, Dr. H. R., 148.
 Cass, Lewis, 39.
 Castilla del Oro, 7, 13.
 Cathedral Plaza, 23.
 Central America, Republic of, 33, 37.
 Cermoise, H., 85, 93, 94.
 Ceron, Alvaro de Saavedra, 28.
 Chagres River, 4, 27, 29, 80, 92, 100, 203, 206, 355, 356, 357, 358.
 Chamé, Point, 363.
 Charles V, Emperor, 11, 15, 29.
 Chauncey, Henry, 45.
 Clay, Henry, 32, 36.
 Clayton-Bulwer treaty, 39, 40, 41, 54, 55, 58.
 Cleveland, Grover, 41, 81.
 Cocoli Hill, 221.
 Cocoli River, 220.
 Colombia, Republic of, 34, 53, 66, 79, 107, 115-122, 123-131.
 Colon, city of, 28, 47, 78, 80, 84-88, 126, 127, 128, 129, 130, 138, 147, 148, 163, 170, 239, 240, 244, 252, 406, 409, 417, 429, 430.
 Colon, harbor of, 4.
 Columbus, Christopher, 3, 4, 11, 12, 28.
 Comber, W. G., 344, 389.
 Cooke, Dr. Robert P., 230.
 Cooke, Thomas M., 345.
 Cordilleras, the, 4, 6, 14.
Corozal, dredge, 385-386.
Corozal, town, 391.
 Costa Rica, 32.
 Costa Rica, Bishop of, 82.
 Cristobal, 79, 151, 170, 266, 267, 324, 328, 396, 399, 402, 438.
 Cruces, 27, 28.
 Cuba, 224 ff.
 Cucaracha slide, 185-188, 190.
 Cueva Indians, 15.
 Culebra, village of, 156, 188.
 Culebra Cut, 6, 7, 73, 108, 162, 168, 171, 178, 184-192, 193-197, 284, 312, 322, 325, 333-341, 351, 352, 353, 354, 380.
 Culebra Island, 138, 393, 416, 418, 430.
 DARIEN, Gulf of, 3, 5, 7, 8.
 Darien, Isthmus of, 30, 66.
 Dauchy, W. E., 191, 331.
 Davis, Admiral Charles H., 55.
 Davis, Arthur P., 208 n.
 Davis, General George W., 146, 147-148, 158, 165, 166, 426.
 De Lesseps, Fort, 413, 414.
 Devol, Colonel C. A., 180.
 Dexter, Dr. E. G., 24.
 Dickman, Ernest, 40.
 Dingler, Jules, 80, 94-95.
Dixie, U. S. Ship, 126, 132.
 Douglas, Stephen A., 55.
 Drake, Sir Francis, 28.
 Dziembowski, 92, 93.
 ECUADOR, 34.
 Egypt, 234.
 Eiffel, Alexandre Gustave, 100.
 Eliot, President, 231, 237.
 Empire, 328, 344.
 Endicott, Admiral Mordecai, 167, 176, 427.
 Ernst, Colonel Oswald H., 176, 426, 427.
 Espinosa, Gaspar de, 15.
 Esquemeling, John, 19, 20, 21, 49.
 Evarts, W. M., 40.
 FERDINAND V of Spain, 12, 15.
 Finlay, Dr. Carlos J., 224, 236.
 Fish, Hamilton, 40, 56.
 Flamenco, island of, 14, 138, 409, 416, 418, 430.
 Freeman, John R., 208 n., 212.
 Froude, J. A., 89.

- GAILLARD, Colonel D. D., 189-191, 192, 388, 427.
 Gaillard, Mrs., 311.
 Gamboa, 80, 322.
 Garella, Napoleon, 35.
 Garibaldi, Giuseppe, 292.
 Gatun, 202, 203, 204, 205, 210, 353, 355, 364, 382, 383, 391, 394.
 Gatun Dam, 202-211, 351, 352, 355-361.
 Gatun Lake, 49, 318, 321, 351, 352, 360-361, 373-374, 380, 385, 406, 417, 419, 420.
 Gatun River, 321.
 Gerig, William, 214.
 Gillette, Captain C. E., 147.
 Goethals, Colonel George W., 176-182, 198, 199, 209, 210, 215, 216, 219, 221, 282, 283, 286-289, 290, 295, 296, 324, 345, 346, 421, 427.
 Gogorza, Anthoine, 66.
 Gold Hill, 6, 186, 188, 322, 394.
 Gorgas, Colonel W. C., 96, 97, 98, 147, 177, 233, 234-236, 238-246, 253 n., 427.
 Gorgona, 79.
 Gracias á Dios, Cape, 7.
 Grant, Fort, 413.
 Grant, Ulysses S., 39, 40, 56, 57, 65, 413, 425.
 Grassi, Dr. B., 232.
 Great Britain, 39, 41, 42, 44, 54, 55.
 Grunsky, Carl E., 426.
 Guam, 433.
 Guatemala, 32.
 Guayaquil, 450.
 Guérard, Adolph, 166.
 Guiteras, Dr. John, 231-232.
 HAINS, General Peter C., 176, 425, 426, 427.
 Harding, Major Chester, 215, 389.
 Harrod, Benjamin M., 159, 176, 426, 427.
 Haupt, Lewis M., 425, 426.
 Havana, 224 ff., 233.
 Hay, John, 118, 119, 120, 121, 123, 124, 125, 133, 134, 135, 136, 137, 193.
 Hayes, Rutherford B., 57, 76.
 Hay-Herran treaty, 118, 123, 134, 139.
 Hay-Pauncefote treaty, 41, 42, 58-59.
 Hayti, 4.
 Hazen, Allen, 208 n.
 Hecker, Frank J., 158, 426.
 Herran, Tomas, 118.
 Hispaniola, island of, 4.
 Hodges, Colonel H. F., 180, 182, 214, 215, 427 n.
 Hoffman, Captain G. M., 215.
 Honduras, 3, 7, 32.
 Hongkong, 450.
 Honolulu, 450.
 Horn, Cape, 11, 45.
 Howard, General Oliver O., 414.
 Hubbard, Commander John, 125, 126, 127, 128, 129.
 Huertas, General Esteban, 131.
 Hughes, Colonel G. W., 46.
 Humboldt, Alexander, 30, 31.
 Humphreys, General A. A., 56, 65, 425.
 Hunter, William Henry, 166.
 Hurlbut, S. A., 40, 56.
 INDEPENDENCE PLAZA, 23.
 Iquique, 450.
 Ismailia, 234.
 JACKSON, Andrew, 33.
 Jacquet, L., 99.
 Jadwin, Major Edgar, 215, 389.
 Jerve, Major J. C., 215.
 Jewett, Admiral, 82.
 Johnson, Andrew, 39.
 Johnson, Emory R., 426.
 Jouett, Admiral James E., 81.
 Juana, Princess, 15.
 Judson, Lieutenant-Colonel William V., 215.

- KILPATRICK, General Judson, 414.
 Kissinger, John R., 228-230, 247.
 Klein, Mateo, 45.
- LA BOCA, 95, 218, 363.
 La Garde, Major Louis, 147.
 La Plata River, 11.
 Lazear, Dr. Jesse W., 225, 226,
 227, 230, 231, 236, 245, 246, 247.
 Le Maire, 11.
 Lepinay, Godin de, 202-203.
 Le Prince, Joseph, 148.
 Lesseps, Charles de, 103, 104.
 Lesseps, Ferdinande de, 57, 65, 66,
 67, 68, 69, 70, 71, 72, 73, 75, 76,
 77, 78, 79, 80, 81, 82, 83, 97, 99,
 100, 101, 104-105, 202, 203, 413.
 Limon Bay, 4, 67, 352, 353, 387,
 403, 410.
 Lord, Austin W., 391.
Louisiana, U. S. Ship, 169, 170.
 Lowell, A. Lawrence, 289.
 Lowell, James Russell, 40.
- MAAS, Clara B., 232.
 McCaw, Major Walter D., 228.
 Macfarlane, James, 346.
 McKinley, William, 114, 427.
 Magellan, Ferdinand, 11.
 Magellan, Strait of, 450.
 Magoon, Charles E., 148, 150, 164,
 176, 244, 426.
Maine, U. S. Ship, 133.
 Mallet, Sir Claude Coventry, 92,
 93, 314-315.
 Mallet, Lady, 315.
 Maltby, F. B., 214, 388.
 Manila, 450.
 Manzanilla Island, 47.
 Manzanilla Point, 409, 413.
 Margarita Island, 394, 408, 409,
 412.
 Maritime Canal Company of
Nicaragua, 58.
 Mears, Lieutenant Frederick, 323.
 Melbourne, 450.
 Mendoza, Carlos, 139.
- Merritt, General Wesley, 413.
 Metcalfe, Richard L., 427 n.
 Millet, Francis D., 171.
 Mindi, 79.
 Mindi River, 403.
 Miraflores, 204, 218, 219, 220, 221,
 353, 362, 363, 364, 366, 382, 383,
 394.
 Miraflores Lake, 220, 221, 366.
 Monkey Hill, 79, 129.
 Moran, John J., 228-230, 248.
 Morgan, General Charles H., 414.
 Morgan, Sir Henry, 18, 28, 416.
 Morison, George S., 426.
 Mount Hope, 79, 397, 403.
 Mower, General Joseph A., 414.
 Muños, Herman, 9.
 Murphy, Dominick I., 426.
- NAOS, island of, 14, 138, 409, 416,
 418, 430.
 Napier, Lord, 39.
Nashville, U. S. Ship, 126, 127, 128,
 129.
 Nelson, Dr. Wolfred, 47.
 New Granada, 34, 37, 38, 39, 44,
 45, 46, 53, 81.
 New St. Andrew, 10.
 Newton, General John, 413.
 New York City, 450.
Nicaragua, 16, 28, 29, 30, 32, 58.
Nicaragua route, 32-35, 55, 57,
 113, 114, 115, 116, 209, 425,
 426.
 Nichols, A. B., 214, 343.
 Noble, Alfred, 165, 166, 212, 426.
 Nombre de Dios, 27, 28, 363.
- OBALDIA, José Domingo de, 124,
 131, 139, 150.
 Oregon, 44.
Orinoco, R. M. steamer, 130, 132.
 Otis, Dr. F. N., 47, 48-49, 50, 51.
- PACIFIC OCEAN, 6, 9, 11, 29, 430.
 Palmer, Aaron H., 32, 33.
 Panama, the name, 14-15.

- Panama, Bay of, 9, 14, 17, 18, 23, 67, 71, 95, 138, 325, 328, 396, 409, 430.
 Panama, Bishop of, 25, 71, 72, 74.
 Panama, city of (old), 13, 15, 16-22, 418; (new) 14, 23-26, 27, 28, 81, 82, 83, 84-88, 138, 147, 148, 163, 239, 240, 244, 252, 417, 429, 430.
 Panama, Indian village of, 14.
 Panama, Isthmus of, 3, 6, 16, 27, 38, 45 ff., 222 ff.
 Panama Canal, 3, 28, 36-43, 57 ff.
 Panama Railroad, first, 44-53, 79-80, 146, 157, 163, 265, 266, 267; the new, 318-323, 398, 401, 403, 406, 429, 435, 436, 449.
 Panama Railroad Company, 45-46.
 Panama Republic, 130, 131, 132-139, 147, 430, 431, 434, 436, 445.
 Paraiso, 79, 204.
 Park, Trenor W., 70.
 Parke, General John G., 413.
 Parsons, William Barclay, 158, 165, 166, 426.
 Pasco, Samuel, 425.
 Paterson, William, 10.
 Patterson, Carlisle P., 57, 425 n.
 Pearl Islands, 9, 10, 14.
 Pedrarias. (See *Avila*.)
 Pedro Miguel, 204, 218, 219, 220, 221, 322, 325, 363, 364, 382, 383, 391, 394.
 Pennell, Joseph, 212, 213, 312-313.
 Perico, island of, 14, 16, 138, 409, 416, 418, 430.
 Peru, 10, 12, 16, 29.
 Pezet, F. A., 95.
 Philip II of Spain, 29.
 Philippine Islands, 433.
 Pierce, Benjamin, 56, 57, 425.
 Pizarro, Francisco, 10, 11, 16.
 Poe, General O. M., 216.
 Polk, James K., 38.
 Porto Bello, 363, 406.
 Port Said, 234.
 Puerto Bello, 28.
 Puerto Bello, Bay of, 4.
 Puerto Carreto (Careta), 5, 8.
 Puerto Escoces, 10.
 QUELLENNEC, Edouard, 166.
 RAGGI, A., 334, 343.
 Raleigh, Sir Walter, 30.
 Randolph, Fort, 412, 414.
 Randolph, Isham, 166, 208 n.
 Randolph, General Wallace F., 413.
 Reclus, Armand, 66, 67, 78.
 Reed, Major Walter, 225, 226-230, 235, 236, 245, 246.
 Reyes, General Rafael, 119-120, 121, 133, 134, 135, 136.
 Rhodes, James Ford, 136.
 Rio de las Balsas, 8.
 Rio Grande, 220, 221.
 Ripley, Joseph, 166.
 Robinson, Tracy, 47, 73-74.
 Rojo, Gabriel, 9.
 Roosevelt, Theodore, 23, 42, 114, 115, 126, 134-135, 137, 138, 143-145, 146, 148, 150, 158-159, 160, 164, 165, 167, 168, 169-174, 175, 176, 180, 181, 185, 191, 198, 199, 208, 209, 211, 219, 238, 259-260, 271, 272, 274, 275, 276, 281, 287, 295, 355, 426, 427.
 Roosevelt, Mrs., 169.
 Root, Elihu, 43.
 Ross, Dr. John W., 147, 148.
 Ross, Major Ronald, 232, 233, 234, 236, 239.
 Ross, Captain W. S., 215.
 Rourke, L. K., 192.
 Rousseau, Armand, 81, 99.
 Rousseau, Rear-Admiral H. H., 181-182, 427.
 Rousseau, Mrs., 311.
 SABANA RIVER, 9.
 Sabanas, the, 416.
 San Francisco, 450.
 San Miguel, Gulf of, 6, 7, 8, 9, 10, 14.

- San Pablo, 406.
 San Salvador, 32.
 Santa Maria de la Antigua del Darien, 5, 8, 15, 16.
 Santiago de las Vegas, 233.
 Santo Domingo, church of, Panama, 24.
 Sault Ste. Marie Canal, 375.
 Schildhauer, Edward, 371.
 Schouten, Willem Cornelis, 11.
 Schuyler, James D., 208 n.
 Sergeant, John, 36.
 Sherman, Fort, 412, 414.
 Sherman, General W. T., 412.
 Shonts, Theodore P., 162, 164, 175, 426.
 Sibert, Colonel William L., 214, 215, 389, 427.
 Simonin, L., 49.
 Smith, General Charles F., 413.
 Smith, Jackson, 177, 180, 427.
 Sosa, Juan B., 9 n., 10, 15, 18, 19, 21.
 Sosa Hill, 218, 391, 392, 393, 396, 397, 398.
 South Sea, 6, 8, 10, 11, 15.
 Spooner Act, 115, 117, 121, 138 n., 144, 158, 160, 204, 261.
 Stanley, General David S., 414.
 Staunton, Lieutenant-Commander Sidney A., 426.
 Stearns, Frederic P., 165, 166, 208 n., 212.
 Stephens, John L., 34, 45, 47.
 Sternberg, Dr. George M., 224-225.
 Stevens, John F., 161, 162, 164, 167, 175, 176, 178-179, 180, 184, 191, 205, 209-210, 218, 266, 271-272, 300-301, 302, 331, 335, 341, 356.
 Stickle, Captain Horton W., 215.
 Stimson, H. L., 408, 412.
 Suez Canal, 65, 69, 375, 402, 450.
 Sutherland, Duke of, 82.
 Taft, William H., 42, 95 n., 146, 150, 152, 158, 159, 161, 167, 174, 191, 208-209, 217-218, 274, 276, 278, 283, 415-416, 418.
 Taft, Mrs., 208.
 Tehuantepec, city of, 55.
 Tehuantepec route, 28, 29, 30, 57.
 Tehuantepec, state of, 28, 29, 30.
 Thatcher, Maurice H., 427 n.
 Thiel, Monsignor, 82.
 Tidball, General John C., 414.
 Tincanizer, Eugen, 166.
 Tivoli, Hotel, 169, 267.
 Tomes, Robert, 47 n.
 Toro Point, 387, 393, 408, 409, 412.
 Torres, Colonel, 127, 128, 129, 130, 132.
 Totten, Colonel George M., 47, 48, 70, 75.
 Tournier, Mr. de la, 334.
 Tovar, General, 127, 128, 129, 132.
 Trautwine, John C., 47, 48, 51-52.
 Türr, Etienne, 66, 67, 68.
 Tutuila, 433.
 UNITED STATES, 32, 33, 36, 37, 38, 39-43, 44, 54-59, 113 ff., 133-139 ff.
 Ureba, Gulf of, 7.
 VALDERRABANO, Andrés de, 9.
 Valparaiso, 450.
 Van Buren, Martin, 34.
 Venezuela, 34.
 Venta Cruz, 27.
 Veraguas, province of, 17.
 WALKER, Rear-Admiral J. G., 114, 144, 150, 204, 425, 426.
 Walker Commission, 114-115, 204, 324-325, 328, 425.
 Wallace, John F., 156, 157, 159, 161, 184, 191, 204-205, 265, 266, 299, 331, 343, 427.
 Ward, C. D., 203.
 Warren, General Gouverneur K., 413.

- Weaver, General E. M., 408, 411.
Webb, General Alexander S., 414.
Weed, General Stephen H., 414.
Welch, Ashbel, 203.
Welcker, J. W., 166.
Welles, Gideon, 55.
Wells, George M., 343.
Williams, Edward J., 345.
Williams, Captain John J., 47.
Williamson, Sidney B., 221, 346,
389.
Wilson, Colonel Eugene T., 180.
Wilson, Woodrow, 43.
Wood, General Leonard, 228, 233,
235, 408.
Wyse, Lucien N. B., 48, 66, 67, 78,
107.
YOKOHAMA, 450.
Young, General, 125.
ZINN, A. S., 344.
Zürcher, Philippe, 185.

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